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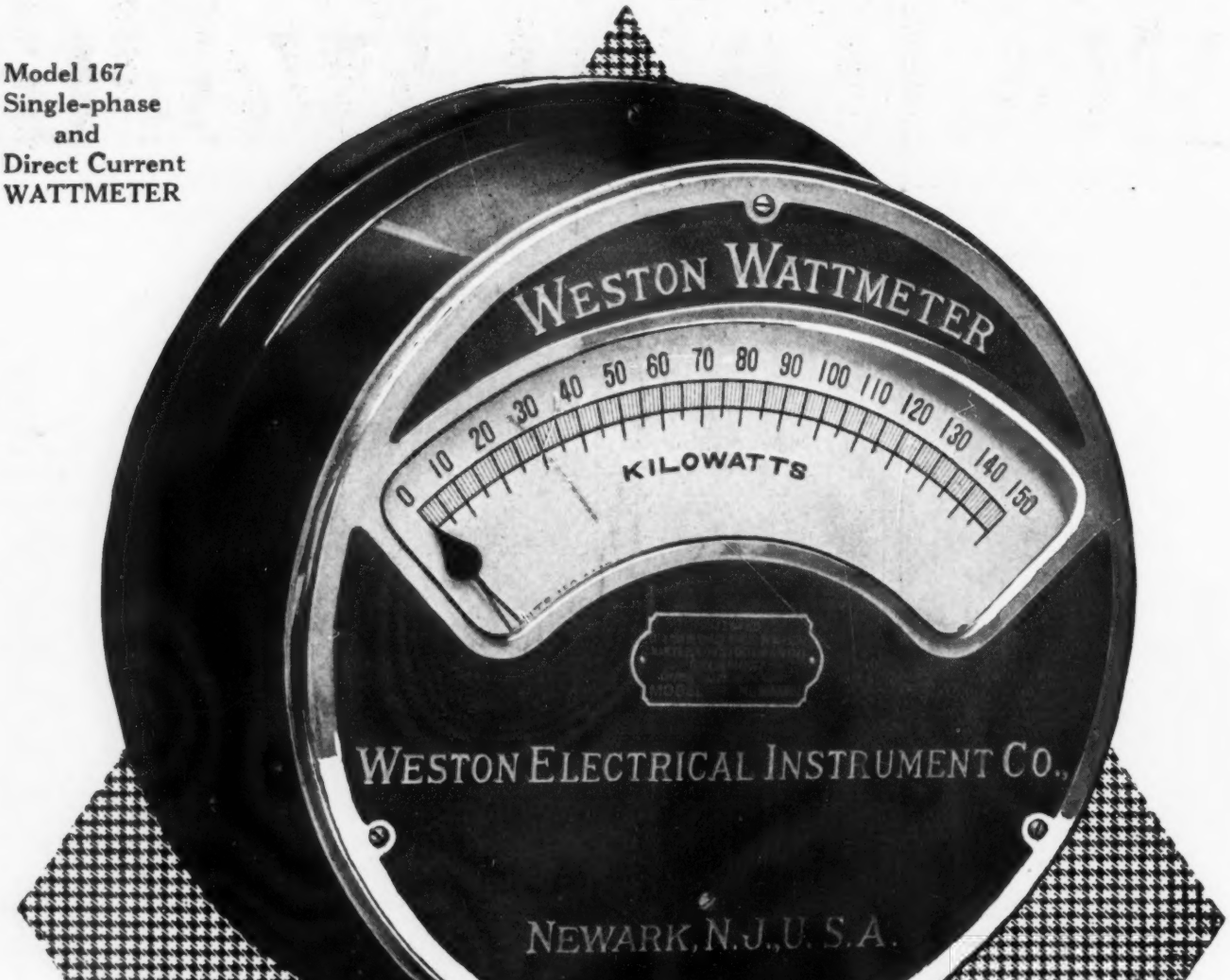
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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Rising Publishing Costs

NEWSPAPER readers are generally conversant with the increasing burdens which all publishers now have to carry. Prices have gone up; but prices are not the only handicaps—freight embargoes and inability at times to get paper at any price are among the other troubles that must be encountered. An appreciation of what this means can be had from the following figures: At the present time the cost of publishing the ELECTRICAL WORLD is 330 per cent greater than it was in 1915. Paper has increased in price 418 per cent; printing, 216 per cent; postage, 275 per cent; salaries and traveling expenses, approximately 100 per cent. True, subscription and advertising rates have been advanced, but not in proportion to the increased costs; and were it not for the enlarged volume of business the publishing company would be seriously handicapped. Inability to get paper has rendered it necessary to print this issue of the ELECTRICAL WORLD with four less reading pages than normally. The service to readers remains the same, the articles being just as numerous but more concentrated.

Theodore N. Vail

THEODORE N. VAIL, unlike Alexander Graham Bell, with whose name the telephone will always be inseparably linked, was not an inventor. He was a business man with a genius for organization. To him more than to any one else the wide popularity of the telephone is due. His was the master mind that conceived and built the American Telephone & Telegraph Company and unified the telephone system from one end of the country to the other. Service was to him not sounding brass or a tinkling cymbal but an obsession. It found expression in the vast telephone system of which he was the head, and it manifested itself in the renewed vigor of the Western Union Telegraph Company when he obtained control. His perception of what was meritorious in invention was no keener than his ability to read men. In the handling of human beings he was a master. Large in stature and big in ideas, he exemplified what was best in American business and will be numbered among the great men of the industry.

A Sensible Solution

KEPT from striking for higher wages from a sense of loyalty to their company and yet believing that a 25 per cent increase was necessary to insure proper living conditions, a committee from the employees of the Colorado Springs Light, Heat & Power Company has put the matter before the Colorado State Industrial Commission. The committee has also petitioned the State Utilities Commission to grant an increase in rates to allow the company to meet the wage increase. Claiming that a precedent was set by the commission in the matter of rates and wages when it granted one of the traction companies permission to increase its fares to 6 cents to meet a demand by its employees for increased wages, the committee feels sure that an understanding will be reached by the two commissions. In these days of unrest in all industries such an example, based on the loyalty of a group of employees, is inspiring. It shows confidence in the institutions the people have created and a willingness to submit questions to the arbitrament of those institutions and abide by their decisions.

Central-Station Purchasing

THE question of purchasing the supplies of material and apparatus required in 1920 should have prompt consideration from central stations which have not already placed their orders. Prices may go up or they may go down, but that is beside the question. The public has a right to expect the utilities to exercise reasonable foresight in their purchasing policies, but high prices should not deter companies from maintaining adequate stocks. Electrical manufacturers are far behind with their orders, and deliveries are getting worse. Even if production could be increased and sufficient raw material could be obtained, it would be of doubtful benefit, because railroads can handle little, if any, more freight over existing tracks. The time has come when the central stations should follow the example of other large buyers and place orders for their requirements at least a year ahead. The supplies can then be shipped according to a predetermined schedule based on estimated needs. The adoption of this or some other method of assuring delivery is essential to the central stations if they intend to maintain their reputation and fulfill their obligation to be ready to serve.

The Needs of the Patent Office

THE National Research Council and the Engineering Council have joined hands in supporting legislation to meet the needs of the United States Patent Office. Not only is the personnel of the Patent Office insufficient in number, thus leaving much work undone or poorly done, but the salaries paid are inadequate for maintaining a competent force. The United States Patent Office employees appear to have had to join the ranks of the many who have not been helped in meeting the continuing increase in the cost of living. It is therefore time that something be done to provide for an adequate and better paid force in that branch of the government work. It is hardly necessary to point out that the present condition with its delays, its probable mistakes, and undoubtedly its low morale, is an obstacle in the path of progress. That our national engineering bodies

are taking action in behalf of the Patent Office is therefore gratifying, and many engineers will doubtless join as individuals in supporting the bill that is at present before the Senate.

Danger of Specialization in Colleges

IT IS genuinely sound thinking that is prompting the faculties of some of our large engineering colleges to oppose the introduction of specialization into their courses. The amazing success of specialized, short-cut methods of teaching used to train men for carrying on specific work during the war has led leaders in the industrial and manufacturing field to call insistently for the application of the same methods in the training of the students they purpose to employ. The argument of these employers is that such men will be valuable from the day they start to work. What they fail to see is that the value of a student thus trained will be limited entirely to specialized subjects and that any change in occupation, due either to business conditions or to the personal inclination of the man, will leave him with no equipment that will help him to adapt himself readily and efficiently to new work. It should be evident that industry does not need such men. What it does need are men able to apply scientific methods to any work because they have a thorough grounding in fundamentals.

The university must teach fundamentals first. After that is it not better to let the graduate feel his way out in industry and find by experience the place where his usefulness is greatest? It is in itself a justification of higher education that those in charge of it see most clearly the way to progress in the training of men. It will be fortunate indeed, in these days when sound engineering is more than ever necessary for the general welfare, if the advantages to be derived by thorough courses can be made more attractive than the somewhat quicker routes to positions with good wages at the start which may be had through superficial instruction in special work.

Burning Low-Grade Southwestern Coals

IN THE aggregate the amount of our heritage from the carboniferous era is enormous, so great that it is difficult to compute, but until recent years the prodigious drafts of industry upon fuel have in the main been made upon the better grades found in the more convenient locations and relatively easy to work. The inroads on fuel of good quality from such sources have been very grave. If commercial exhaustion of good coal, both anthracite and bituminous, is to be postponed over a period of many years, it must be by utilizing the less promising kinds of fuel. It is with these that W M. Park has to deal in an article elsewhere in this issue. The coals he brings especially to view are those of the Southwest—a little anthracite, some rather poor semi-anthracite, much bituminous, and considerable lignite running as low as 6,000 B.t.u. As a whole, these Southwestern coals are quite rich in volatile matter, clinker rather readily and carry a high proportion of ash, reaching in some cases nearly 40 per cent. Semi-anthracite is of low volatility and hard to burn.

The interesting feature of Mr. Park's investigations is that even some of the worst of these coals can be burned at fairly high efficiency, passing 70 per cent, if proper conditions for combustion are obtained. In general these conditions, varying somewhat from fuel to fuel, are similar to those for other low-grade fuels—large grate capacity, big furnace space, and in many cases, particularly, long high-set arches. Chain grates seem in general to work well if properly installed and provided with a somewhat heavy draft. But under suitable conditions, and the secret here is chiefly furnace space and draft, almost any of these low-grade fuels can be worked with fair success and considerable economy. The result is extremely encouraging from the standpoint of fuel supply, and it is altogether evident that the time has arrived when the program for coal conservation must include the utilization of such coal.

Mechanical Standardization of Motors

AT THE present time, when the production cost of motors has been considerably increased and their use is rapidly extending, it becomes pertinent to inquire whether it may not be possible to keep down costs and thereby increase use through a cautious but thoroughgoing course of standardization. The variety of motors of closely similar electrical design is something prodigious. No very great differences are now to be found in general properties of motors produced by a considerable number of makers. Standard voltages, frequencies, specifications for temperature rise and the like, together with a somewhat general effort at standardized normal speeds, mark a certain uniformity of practice that has been of help. Nevertheless, there is a vast variety in the product of any single manufacturer. In output the machines run from about one cat-power to several thousand horsepower. Through this great range there is still considerable necessary diversity in speeds, especially in some sizes, to say nothing of differences in voltages and in form of winding. To these characteristic differences of design may be added not a few due to the utilization of motors for the directly connected tools and other conditions where special mechanical arrangements have to be adopted. All this means increased cost and inferentially some decrease of use.

C. W. Starker in this issue makes a strong and justified plea for an effort at mechanical standardization, which can certainly be carried out to a very considerable extent without meeting serious difficulties. He points out, for example, that a single concern, manufacturing by no means a wide range of motors, produces sixty-five different types of brush holders, twenty-seven sizes of oil rings and a similar number of bearings of odd bore and length, to say nothing of a preposterous variety in the smaller parts. All this complication, which had its origin in the growth of the art, cannot now be considered as in the least necessary or desirable. The mechanical details of a motor in such features as these have virtually no effect for better or worse on the electrical design. If the varieties could be considerably reduced in number by formal or informal standardization, the processes of manufacture would be much facilitated and costs by quantity production could probably be materially reduced. Labor is the serious item at present in all manufacturing processes, and to dispense with a certain amount of this even at slightly greater cost of raw material would mean no inconsiderable gain. A great many special sizes of motors are in reality rather unnecessary, having been the product of fancy rather than genuine need. Mr. Starker gives some striking

data regarding the distribution of sales between the various sizes of smaller motors, from which it appears that the demand tends to fall into well-defined groups so that really a few mechanical forms would suffice to meet the whole genuine requirement. The same sort of thing would hold for a much wider variety of motors adapted to various uses. Now and then some very special form may be required in such large numbers as to justify a highly specialized design, but this is the exceptional and not the usual case.

Effectively Lighting a Large Interior

DESPITE all well-meant efforts to reduce practical lighting to a conventional level expressed in watts per square foot, the illuminating engineer finds himself not infrequently confronted with problems not to be solved by charts or the slide rule—problems in which harmony with architectural effects and the beauty and appropriateness of the results are the controlling factors. An excellent example of such a case is that described in this issue by James R. Cravath, one occurring in the ordinary course of his illuminating practice. The problem which confronted him was an unusual one, that of lighting the so-called atrium of a great hotel at West Baden Springs, Ind., a circular room some 200 feet (60 m.) in diameter with a dome 110 feet (33 m.) high. This great inclosed space is used chiefly as a "lounge," although at times as a ballroom and for other gatherings of a festive nature. Lighted from skylights by day, the normal condition was brilliancy in the upper part of the dome, shading off toward the widespread ground level. This same idea was carried out by the architect in his scheme of decoration, in which the color was toned from a tawny hue at the floor line to a hue substantially white at the center of the dome far above.

To deal with this situation and produce illumination which would harmonize in shading with the decorations, Mr. Cravath adopted a bold expedient, lighting the whole great space from a single colossal indirect fixture, a highly decorative structure framed in steel and 27 feet (8.1 m.) in diameter at a general level of about 100 feet above the floor. It is a mirrored fixture with eighteen 1,000-watt lamps in two tiers throwing their light, deftly shaded, from the mirrored structure upward and outward upon the dome. The bottom of the fixture is in ornamental plaster grillwork. A ring of lamps provides indirect light for illuminating this grill by reflection from the under side of the fixture floor and the backs of the main mirrors, all painted in tones to match the general color scheme of the interior. Finally a pendant to tone the light upon the grillwork, hung 12 feet (3.6 m.) below the center of the fixture, furnishes light from three mirrored reflectors. For floodlighting the atrium when *en fête* the pendant is lowered away, exposing four circular openings in the middle of the fixture, each carrying a powerful floodlamp the color of which can be modified by a revolving disk containing suitably tinted gelatine screens. The whole installation furnishes roughly a foot-candle of illumination on the floor, with a utilization factor of about 10 per cent—quite high enough where decoration is the fundamental purpose of the lighting scheme. Brackets on the columns, equipped with lamps having iridescent shades, furnish a decorative element below the main body of the dome, and table lamps give additional light for readers. The entire scheme strikes one as an extremely clever piece of decorative work, with illumination as the means rather than the end.

Engineers' Building in San Francisco

THE movement for the construction of an Engineers' Building in San Francisco, in which will be centered the activities of the engineering professions and trades of that community, is in line with the policy advocated by the ELECTRICAL WORLD. With the principle in mind that strong local organization is the first requisite to success in the broader fields of engineering enterprise and joint engineering activities, public-spirited engineers in the California city are endeavoring to enlist the support of organizations and individuals interested in carrying the building project through to completion. Their aim is to make it a true "civic center" of engineering interests. While the proposal is as yet tentative, the real need for such an institution and the determined manner in which the originators of the plan are setting to work seem to assure its complete success. This will be as it should be, for the idea merits wide consideration, and if San Francisco carries it through with characteristic enterprise, it will undoubtedly be adopted in other great industrial centers of the country.

Alleviating Short Circuits

ONE of the gravest features of modern central-station practice is the danger of short circuits involving all or a substantial part of the generating capacity. Especially does this bear on switchboard design and the capacity of the various circuit-breaking devices. In its crudest form the problem presents itself thus: Given n generators each of m kva. capacity, how shall one avert the necessity of providing a rather general equipment of circuit breakers, each capable of handling not only mn kva. but the corresponding short-circuit output? Around this problem centers the whole art of switchboard design and equipment. Elsewhere in this issue R. F. Gooding presents another of his very useful studies of the ways and means available for keeping short-circuit currents within reasonable reach of available circuit-breaker capacity. In particular he considers the technique of working with reactances to the best advantage, both on the primary and the secondary side. The best arrangement is not necessarily the most obvious, and the actual working out of the complex problem is given in some detail. Reactances have their limitations in the effect on the regulation; their cost, too, is far from negligible. They are, however, useful palliatives which can be put to good use. In fact, in a complex system one is always confronted by the cost and trouble of anything like full protection, and a point is finally reached where there is very strong temptation to take certain chances rather than go to the elaborate precautions necessary to guard against them. The method of group feeding outlined by Mr. Gooding has much to recommend it. In fact, we are inclined to the opinion that the concentration of the whole capacity of a big plant on a general busbar system, even sectionalized, is of dubious advantage. The gain in instantaneous flexibility hardly seems to compensate for some of the difficulties introduced, and there is much to be said for what may be called loose coupling with groups normally limited in interchange capacity.

Herbert A. Wagner

A pioneer in installation of alternating-current lighting systems, founder of the large electrical manufacturing company that bears his name and an able central-station executive

UNDER the supervision of Herbert A. Wagner, the first incandescent lighting plant in St. Louis, Mo., was installed in 1889. It was operated by the Missouri Electric Light & Power Company, later the Missouri Edison Company, now a part of the North American company's system in that city. As general superintendent Mr. Wagner worked out and placed in successful operation many of the features of present-day alternating-current distribution and transmission systems. Among these was the first series alternating-current arc-lighting circuit fed from the same station bus as power and incandescent lighting. About 4,000 direct-current series arc lamps were rebuilt for this purpose. Large single-phase direct-connected generators operated in parallel were installed for this system in 1895. In 1890 Mr. Wagner founded the Wagner Electric Manufacturing Company and began the manufacture of alternating-current fan motors in a small way. In this enterprise he was associated with the late S. M. Dodd, the organizer of the Missouri Electric Company and a prominent figure in St. Louis' industrial life for more than half a century. It was the urgent need of the Missouri Edison Company for better distributing transformers that led Mr. Wagner to extend the manufacturing business into the field of transformer work. The name of the Wagner company will, of course, always be associated with the introduction of the first successful alternating-current single-phase motor. These motors were first developed by Mr. Wagner for use in furnishing power from incandescent lighting mains.

It has fallen to the lot of very few electrical engineers both to build up a great manufacturing company and to develop a large central station. This Mr. Wagner has done, and in two widely separated states. In 1908 he relinquished a consulting engineering practice in St. Louis and New York to undertake the direction of the electrical division of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md. He became vice-president of this company in 1911 and president in 1915. In its service Mr. Wagner has initiated many progressive methods and built up a business which measured in kilowatt-hours stands twenty-sixth among central-station outputs of the country. Since the early days of the National Electric Light Association he has taken an active interest in its affairs, serving on its public policy and executive committees, as vice-president in 1914 and 1915 and as president in 1916. Mr. Wagner was born Feb. 24, 1867, at Philadelphia, Pa.

Artistic Lighting of a Large Interior

Lighting of West Baden Atrium Was Designed to Harmonize with Decorative Scheme of Architects—Results Accomplished Largely by the Indirect Method, Giving a Utilization Factor of About 10 per Cent

By J. R. CRAVATH
Consulting Engineer, Chicago

ONE of the largest inclosed courts in the world, one well known to visitors at the West Baden and French Lick Springs in Indiana, is that of the West Baden Springs Hotel, commonly known as the "atrium." This hotel has its rooms arranged in a circle around this great court. The atrium has been for years a famous lounging place, offering indoor warmth with much of the sense of outdoor freedom during weather when outdoor lounging would not be comfortable. Incidentally it is a concert hall of remarkably good acoustic properties, of which the hotel management takes advantage several times each day for the pleasure of its guests. The artificial lighting of this court, which it is the purpose of this article to describe, was designed by the writer with the desire that it should harmonize with and form an important part of a beautiful scheme of interior decoration.

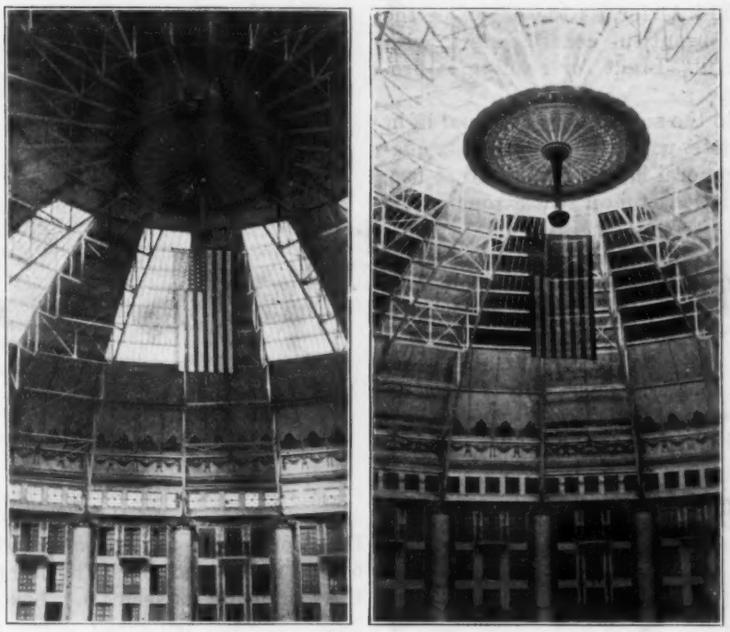


FIG. 1—LIGHTING OF DOME FROM ABOVE AND BELOW
Eighteen 1,000-watt lamps are used in the large indirect fixture above.

No photographs have ever been obtained which give an adequate idea of the atrium, owing to its great dimensions, both horizontally and vertically and its circular form. It is 200 ft. (61 m.) in diameter by 110 ft. (33 m.) high. The steel roof trusses converge to a hub at the center. Fig. 2 is a vertical cross-section through the center of the atrium, showing the approximate contour of the roof. Fig. 3 shows photographs taken by day and by night.

To understand the plan of the lighting, the decorative scheme must first be described. The background is all light in color, starting at the floor line with a color of light tan and gradually toning to nearly white at the center of the roof. The trim is verde antique. Along with a redecoration program the management wished to provide a plan of general lighting which would harmonize with the decorations. It seemed evident that the general lighting scheme provided must insure a gradual toning off of the brightness from the center of the roof down to the floor in much the same way as the toning off of the decorator's color background. To do otherwise would be to work at cross purposes. This, together with the shape of the interior, pointed to the necessity of having the central hub of the roof structure the brightness center of the upper interior. It was already the architectural center. As already intimated, the principal use of the atrium is as a lounging place, and therefore glare would be entirely out of place. At the same time, when fully lighted, it must be bright enough for dancing and social functions. The plan, as worked out, provides for a number of different lighting effects, ranging all the way from subdued localized lighting from table lamps and brackets alone to general lighting of the whole interior.

Design of Dome Lighting Fixture

The general lighting is mainly by the indirect method, using a fixture of very unusual design and size, shown in the photographs and in detail in Fig. 4. This fixture is directly under the steel hub of the roof structure and acts as an ornamental bottom for it. The hub is a steel cylinder 16 ft. (4.9 m.) in diameter and about 10 ft. (3 m.) high. The fixture is a steel-framed structure about 27 ft. (8.2 m.) in diameter. It is doubtless safe to say it is the only one of its kind in existence. For the general lighting of the atrium eighteen gas-filled tungsten lamps of 1,000 watts each are arranged in two circular tiers around the outside of this fixture. Each tier has nine lamps. Around the outside of the fixture, as shown, there are glass-plate mirrors which form a continuous covering or sheath for the steel structure, so that all light from the lamps incident upon the fixture is reflected outwardly or upwardly. Openings are provided which enable men to get out on the lower flange of the hub of the roof structure to clean these mirrors and renew lamps. The position of mirrors and lamps is designed to produce a gradation of brightness from the center of the roof to the lower walls. Direct light from the lamps ends about the second floor. Sharp demarkation between the zone of direct light and that

of totally indirect light was to be avoided, and the arrangements shown accomplish this purpose well. Although no accurate tests of average illumination have been made, the installation when new showed illumination of one foot-candle and upward on the floor with all of the general indirect lighting turned on. This corresponds quite closely to the utilization factor of 10 per cent assumed in the preliminary calculations. The average illumination on the floor in this case, however, is only of importance as it indicates the general conditions of brightness of the interior, as the object of the lighting is to produce a beautiful general effect, with light enough to be cheerful. Light for reading is provided by the table lamps.

The brightness given to the surfaces by artificial light is one of the most important points. When the installation was new, with the general lighting units all in use, this was as follows, as viewed from a seat at one of the tables on the main floor:

Position (See Fig. 2)	Brightness in Millilamberts
(a) Near center of floor	0.77
(b) Half way up on wall	0.48
(c) Near edge of roof	0.94
(d) Near center of roof	4.33

In addition to concealing powerful lamps for general lighting, the fixture is also one of the notable decorative features of the atrium. The bottom of the fixture is an ornamental plaster grill-work designed to be in harmony with the other decorations of the atrium. In lighting a grill-work of this kind from above two things are important, diffusion and proper control of color. If there is not proper diffusion, there will be unpleasant glaring spots of light in the grill-work and other portions will be dark.

DOME FIXTURE IS ARTISTIC

To bring out the whole design of the grill the lighting must be fairly even and well diffused as it comes through the grill. Reasonably good diffusion can be obtained by various opal skylight glasses, but proper control of both color and diffusion by means of these glasses is difficult to obtain and likely to involve very annoying delays in securing just what is wanted. Therefore the plan used in this case was to provide indirect light for the interior of the fixture behind the grill-work, thus putting both color and diffusion well under control. For this a ring of 75-watt lamps, twenty-four in number, with flat reflectors pointed upward, is used in the

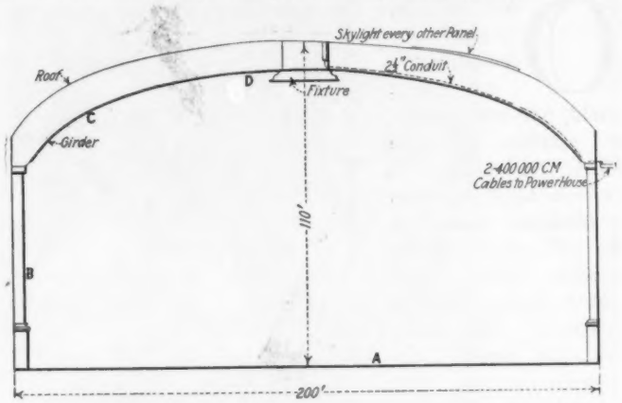


FIG. 2—PRINCIPAL DIMENSIONS OF WEST BADEN ATRIUM

space above the grill-work. These lamps throw light up against the backs of the mirrors and the under side of the floor of the switchroom, which is in the steel hub of the roof structure. The light which comes through the grill-work, as seen from below in the atrium, is the light reflected from the under side of this floor and mirror backs. By painting these diffuse reflecting surfaces the proper color, very beautiful and harmonious color effects are obtained.

In the ordinary program of daily operation during the early evening only the table and bracket lamps and the grill-work lamps of the main fixture are turned on.

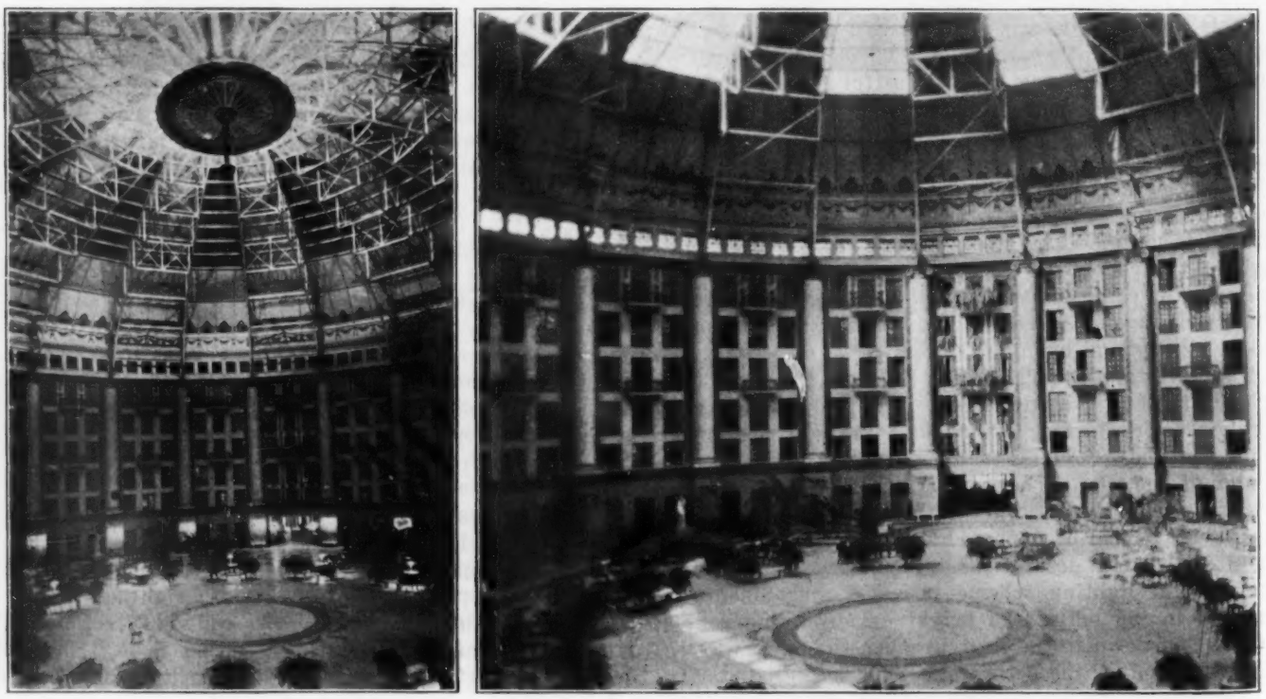


FIG. 3—NIGHT VIEW, FULLY LIGHTED; DAY VIEW WITH SUNLIGHT EFFECTS

This gives a subdued decorative effect. Later the general indirect light is turned on.

To light the grill-work of the fixture from below so that it will not appear altogether in silhouette, three mirrored reflectors were put in a pendant hanging about 12 ft. (3.6 m.) below the grill-work. In the decorative lighting of this fixture (independent of the general lighting it gives) three different effects can be obtained. With the grill lighted from above and below, which is

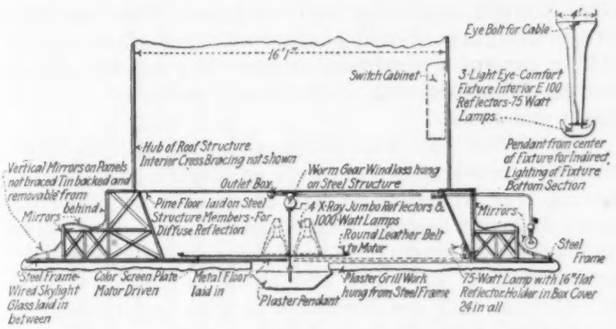

Eye Bolt for Cable
16'1"
Switch Cabinet
3-Light Eye-Comfort Fixture Interior E 100 Reflectors-75 Watt Lamps
Hub of Roof Structure Interior Cross Bracing not shown
Pendant from center of Fixture for Indirect Lighting of Fixture Bottom Section
Vertical Mirrors on Panels not braced Tin backed and removable from behind
Worm Gear Windlass hung on Steel Structure
Outlet Box
Pine Floor laid on Steel Structure Members-For Diffuse Reflection
4 X-Ray Jumbo Reflectors & 1000 Watt Lamps
Round Leather Belt To Motor
Mirrors
Steel Frame
Steel Frame-Wired Skylight Glass laid in between
Color Screen Plate Motor Driven
Metal Floor laid in
Plaster Pendant
Plaster Grill Work hung from Steel Frame
75-Watt Lamp with 16" Flat Reflector Holder in Box Cover 24 in all

FIG. 4—SOME DETAILS OF CENTRAL FIXTURE MOUNTED IN THE DOME

the most pleasing combination and the one generally used, colored light comes from above through the grill-work and enough light is thrown up against the grill-work from the lamps in the pendant to bring out the design of the grill-work itself. With light coming through the grill and very little light from below the grill appears in silhouette. When the light above the grill is turned off and the indirect light from the pendant turned on, the grill-work is lighted from below only, giving a third effect on the grill.

Four gradations of intensity of the general illumination can be obtained by switching. Four switches control the general indirect lighting, and the 1,000-watt lamps on the big fixture are grouped upon these switches as follows: Three lamps equally spaced on the upper tier; six lamps equally spaced on the upper tier; three lamps equally spaced on the lower tier; six lamps equally spaced on the lower tier.

The switching is all done by remote-control switches housed in a switch cabinet in the hub of the steel structure above the fixture. These switches are controlled from the main floor of the atrium by the usual remote-control push-button switches.

FLOOD-LIGHTING WITH DIFFERENT COLORS

In addition to the regular lighting equipment of the central fixture, which is intended for ordinary service, a colored flood-lighting equipment has been provided for use on special occasions. When this is to be used the pendant is lowered to the floor by means of a windlass and is taken away. The removal of the pendant exposes four circular openings in the middle of the fixture, above which there are four "Jumbo" mirror reflectors each containing a 1,000-watt lamp. These are for flood-lighting the center of the atrium. To change the color of this flood-lighting, a color disk of steel with sixteen openings for colored gelatine screens is placed in such a position that it can be rotated under the four "Jumbo" reflectors so as to bring four different colors successively underneath the reflector opening. The rotation of the color disk is by means of a small electric motor, the movement of which is controlled by a push-button in the main control cabinet. It is not the idea that this motor be operated continuously, but at frequent intervals, thus preventing any color from getting ineffective.

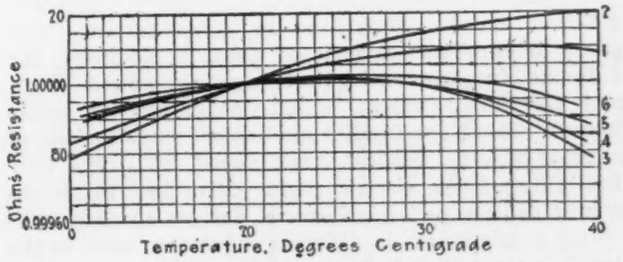
A scheme of this kind is not effective unless color changes can be made frequently, as the eye soon adapts itself so completely to any prevailing color that it is of no particular significance. The localized decorative lighting of the main floor, as before explained, is by brackets and table lamps. There are twenty-four brackets, one on each of the column bases. These are largely for decorative purposes and are provided with iridescent shades. Besides the brackets, there are twelve table lamps arranged symmetrically about an open central area. These can be removed to clear the floor when desired.

Controlling Temperature Coefficient of Manganin

INVESTIGATORS have observed large variation in the temperature coefficient of commercial manganin wire. Dr. Rosa has reported that samples of manganin tested in the Bureau of Standards between 15 deg. and 30 deg. C. have shown a temperature coefficient varying between four and twenty parts in a million per degree, but this sometimes exceeded twenty parts per million. The variation of resistance with temperature of six samples is given in the accompanying curves and the analysis of each of these samples is shown in the table.

DATA ON THE TEMPERATURE COEFFICIENT OF MANGANIN

Sample	Analysis of Material Cu	Mn	Ni	Fe	Temp. Coeff. Resistivity in 18°–24° C. Michrom-cms.	
1	88.02	9.93	1.74	0.24	1.2×10^{-5}	34.2×10^{-6}
2	87.24	10.26	1.77	0.52	1.5×10^{-5}	37.4×10^{-6}
3	88.20	8.84	1.78	0.93	0.33×10^{-5}	55.6×10^{-6}
4	83.60	12.03	3.41	1.04	0.22×10^{-5}	47.8×10^{-6}
5	84.72	12.83	2.08	0.73	0.38×10^{-5}	50.8×10^{-6}
6	84.07	12.98	2.60	0.82	0.57×10^{-5}	51.1×10^{-6}



VARIATION OF RESISTANCE WITH TEMPERATURE OF MANGANIN

It should be observed that the percentage of manganese, between the limits used, affects the resistivity of the wire, but has no effect on the temperature coefficient of resistance. The presence of iron, on the other hand, affects the temperature coefficient to a considerable degree. Those wires in which the iron content was low did not show the temperature coefficient reversal which is characteristic of a manganin wire. The results show that the presence of iron up to 1 per cent improves the temperature coefficient of the resulting alloy. It is also stated that during the annealing of the wire scrupulous care must be observed to avoid its oxidation and that, further, to stabilize the wire it is sufficient to anneal this at 150 deg. C. in an oil bath for a period of five hours.

Mechanical Design of Electric Motors

Standardization of Mechanical Features Necessary for Economical Manufacture—Standards Between Manufacturers Are Not a Bar to Progress—Cost Analysis and Sales Conditions as Basis of Design

By C. W. STARKER
Roth Brothers & Company, Chicago, Ill.

MANUFACTURING costs of electric motors may be reduced, production and sales increased by establishing standards for all motor manufacturers of such mechanical features as shaft and bearing sizes, base dimensions and heights, brush sizes, etc., so that parts may be used in common for a considerable range of ratings and motors of same characteristics, but different make, may be interchangeable. Considerable progress has been made in standardization of electrical features. Standard voltages, standard frequencies, standard temperature rises and so on have been adopted and are uniformly adhered to by motor manufacturers. But on the mechanical side practically no progress has been made. The mechanical design of a standard line of apparatus must have as its foundation the proper appreciation of the conditions peculiar to the industry, of market requirements and of manufacturing conditions.

The electric motor industry differs from other lines of manufacture in several respects. Where a machine tool or pump builder manufactures, at the worst, a few dozen different sizes and types, or the automobile manufacturer a single unit, the electric motor manufacturer has to deal with literally thousands of different ratings, sizes and types. The class of industrial motors alone comprises a range from say a graphophone or sewing-machine motor, rated at perhaps 0.02 hp., to the large motors for steel-mill drives of capacities in the thousands of horsepower. Each one of the different horsepower ratings is again built for different voltages and different speeds, alternating or direct-current, two-phase or three-phase, some of them single-phase, for different frequencies, squirrel-cage or wound rotor, and for direct-current, shunt, compound or series wound. There are further mechanical modifications of a great variety, vertical, back-geared, etc. The very flexibility of the electric motor drive has led to an almost endless variety of special designs to meet individual requirements in different industries, such as the textile or printing industry, steel mills, cranes, elevators, machine tools and so on.

Generators, differing to a varying extent from the corresponding motor type, and their special modifications, as for instance, for high-speed (turbo) work or for low-voltage (electroplating) service, must be considered.

Opportunities for Standards in Mechanical Design

These few examples have been enumerated because a full appreciation of the diversity of product in the electric motor industry is essential to the proper attitude on design questions. That, under these conditions, manufacturing, quantity production, equipment, stock-keeping all become quite different from the same operations in other industries and much more difficult is apparent. The mechanical designer can do a great deal—perhaps more than any one else in the organization—toward improving this condition. The best skill of the designers should be devoted to an effort toward taking care of a maximum number of required ratings and modifications with a minimum number of different parts and tools.

The writer has data from one company, manufacturing a rather limited range of electric motors, but having, for example, no less than sixty-five different types of brush holders, most of them made, at one time or another, in several different sizes; twenty-seven different sizes of oil rings and about as many varieties of bearings with odd bores and lengths, not to mention the fertility of its designers' brains in those small parts, such as oil-hole covers, tubes, washers, bolts, etc., which are generally called details but which in production usually cause delays and difficulties in obtaining material and keeping stocks.

That, under the condition described, economical manufacture is impossible will be understood. If, on the other hand, slot sizes, for example, are so designed that they are common for many different ratings and that, therefore, combination dies are warranted, or if bearing sizes, brush holders and slide rails are designed so as to be applicable to a great number of sizes, perhaps interchangeable between alternating current and direct current, then manufacturing cost is decreased by quantity production and best tool equipment, output is facilitated, and idle investment in the form of excessive stock is reduced. This feature is one of the important considerations in connection with the design of electric motors.

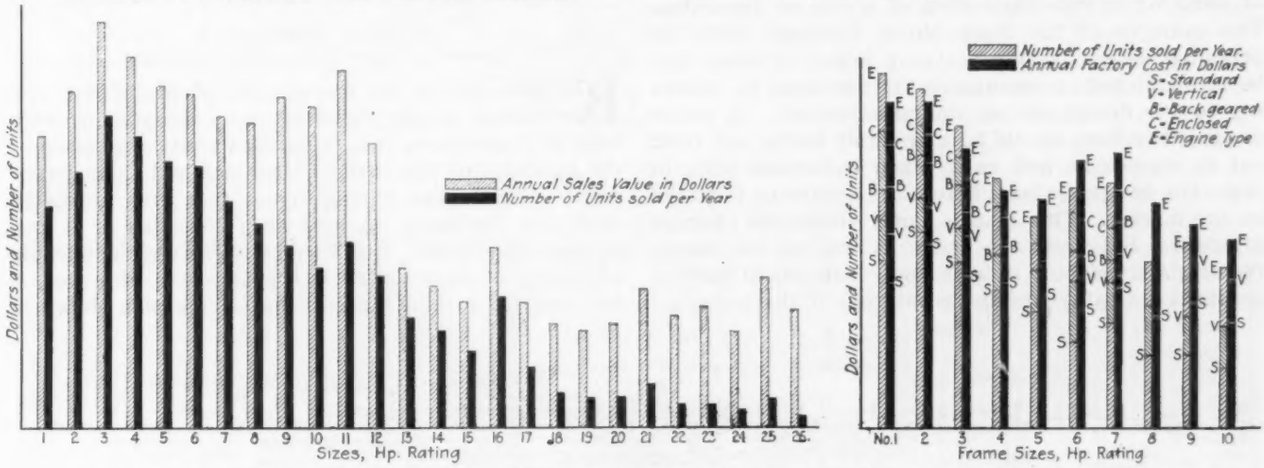
The "Uniform Design" Idea

If one manufacturer can standardize a certain limited number of bearing sizes, brush sizes, pulley bores and so on, it would seem that such standards could also be agreed upon between manufacturers. If one 5-hp., 1,800-r.p.m. motor has a 1¼-in. diameter shaft extension of certain length and keyway, there is no apparent reason why another make of motor, of the same rating, should have a shaft of 1⅛-in. or 1⅞-in. diameter or different key, inconveniencing thereby the motor user as well as the manufacturers of pulleys, couplings, gears, etc. The point will be appreciated by those who have had to maintain a stock of repair parts for large motor users, as, for example, in steel mills.

This idea, it has been suggested, might be carried further. If a certain rotor diameter or slot number is found best by leading engineers—and it may be said that present practice differs in fact little, at least for certain smaller sizes of alternating-current motors—why not adopt it as a standard, permitting thereby uniform over-all dimensions, base drillings, etc.? It may rightly be argued that standardization always has proved an economic advantage and has furthered the industry rather than handicapped it or produced the dire results predicted by some. Take, for example, the fact that even the standard railroad track gage was

objected to at one time on the ground that car control was not feasible unless each road or group of roads had a gage differing from others. On the other hand, take the incandescent lamp industry, where standard sockets, standard filaments and mountings have led only to greater expansion of trade and a greater number of companies engaged in profitable manufacture.

curve like this, plotted for an individual machine size, may be combined with a curve as Fig. 4, in order to tell a complete story. The proportion between labor cost and material varies with the size of machine. Labor cost is relatively highest with the smallest size. Material cost becomes of increasing importance with increasing size, while expense for machining becomes


Dollars and Number of Units
Annual Sales Value in Dollars
Number of Units sold per Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Sizes, Hp. Rating
Number of Units sold per Year.
Annual Factory Cost in Dollars
S-Standard
V-Vertical
B-Back geared
C-Enclosed
E-Engine Type
Dollars and Number of Units
No.1 2 3 4 5 6 7 8 9 10
Frame Sizes, Hp. Rating

FIGS. 1 AND 2—RELATIVE IMPORTANCE OF VARIOUS MOTOR SIZES AND INFLUENCE OF FRAME MODIFICATIONS ON FACTORY COST

Fig. 1—Units used for horsepower rating are for various ratings reduced to a common basis, considering differences in speed, etc. Horizontal axis (Fig. 2) actually gives frame sizes of direct-current motors.

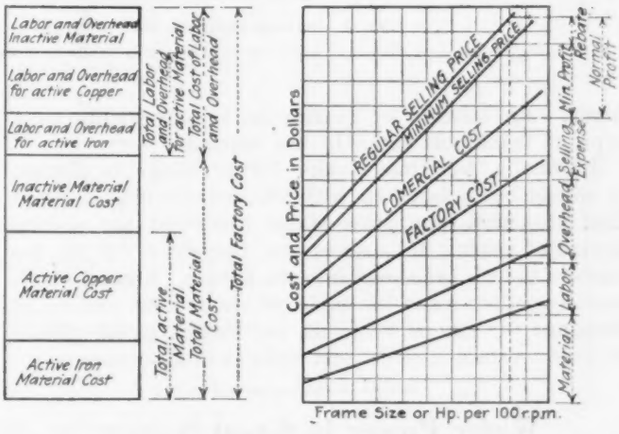
The automobile industry, with standards for many parts, and other industries might also be cited. A closer approach to a mechanical standardization of electric motors seems bound to take place in due time. Unfortunate methods of attacking the problem have been in part answerable for the lack of progress to date.

Relation Between Sales and Design

That designing is not merely a matter of engineering calculation and formulas, but rather a matter of judgment and experience, is further emphasized by considering the relative importance of various ratings and frame sizes according to the number of units sold per year. This may be shown graphically, as in Figs. 1 and 2. The former shows the annual sales value as well as the number of units sold of each frame size, while the latter illustrates the relative importance of the standard horizontal type as compared, for instance, with the vertical type, back-geared modification and so on. Similar curves or diagrams may be plotted for various ratings of a line of motors. If, then, it be shown, for example, that on a basis of annual sales value certain ratings greatly exceed others in importance, or if on some of them the sales volume is so small as to render them negligible, it is clear that the designer should concentrate on the large sellers and make no compromise in their design in order to accommodate, perhaps, a far less important seller. Obvious as this may seem, the point is often neglected. Designing is as much a commercial matter as it is an engineering proposition; the object is profits from sales, and the theoretically best design should not be chosen in every case.

A complete analysis of manufacturing costs for similar apparatus should be available to the designer of a new line of apparatus for his guidance as to material cost as well as labor items. A diagram may be plotted, as in Fig. 3, which shows, on the basis of cost, the relative proportion of active and inactive materials. A

of less significance. This is a point worth remembering in designing and one that should be checked up as the design work progresses. With large machines the point just referred to fortunately harmonizes with the fact that these machines are usually sold in smaller yearly numbers; that is, they justify only a limited expense for tools, which, moreover, owing to their size, are costly. The cost per pound of a machine, it will be apparent, is therefore a criterion only within a limited range of machine capacity.



FIGS. 3 AND 4—DIAGRAMS SHOWING PROPORTION OF LABOR AND MATERIAL COST AND INFLUENCE OF MOTOR SIZE ON COST

Referring more particularly to material value, Fig. 3 shows the relation between active copper and active iron in the machine. A machine might be designed, within limits, with relatively more iron and less copper. The proper balance will depend on the relative cost of these two materials. In years past, with copper at 10 cents a pound, a design might well be different from a design correct on a 30-cent copper base.

Motor users as well as manufacturers are today under a handicap due to the many more or less obsolete types of motors still in use. Changing a design should be undertaken only after very careful consideration and only if warranted by marked progress in the art. There is nothing more costly and more disturbing to regular manufacture than continued changes in design of parts or of individual sizes of a line of apparatus. The example of the Ford Motor Company with its perennial design teaches a strong lesson of what may be accomplished in manufacturing processes by adhering to one design for an unlimited period. A motor design, therefore, should be thoroughly tested and tried out in service as well as by shop endurance tests to prove the design features before the apparatus is placed on the market. This plan not only eliminates changes afterward, but from the user's as well as the manufacturer's standpoint it is the only economical method and tends to safeguard the reputation of the manufacturer. An attempt at continuous improvements on a type of machines works in the opposite way.

If, finally, the time is ripe for a change in design, it should be undertaken with the definite idea in mind that the new type must stand unaltered for a long period of years. It is necessary, therefore, for the designers to look far ahead into the future. Special application studies must be made where motors are to be designed for special work, as, for instance, coal-mining motors, certain textile installations and others.

Water Power in Great Britain

Although the water power available in Great Britain for electrical development does not bulk largely, statistics printed for a combined steam and hydro-electric station established at Chester in 1913 show that as an auxiliary to steam stations, at any rate, it is by no means a negligible factor. At the station named the greater part of the energy sold is generated by water power and is produced at a cost per kilowatt-hour of 0.0823d. (0.16 cent at the old rate of exchange) as against 0.9308d. (1.86 cents) for energy generated by steam.

Wiring Layout for Large Repair Shop

Points Considered in Locating Load Centers and Installing Feeders for Direct and Alternating-Current Service—How Flexibility Is Obtained

BY H. L. CORNELISON
Electrical Engineer the Austin Company

BEFORE laying out the general wiring of the new locomotive repair shops of the Pennsylvania Railroad at Logansport, Ind., a detailed study was made of the locations of the various machines and their power requirements. The wiring layout that first suggested itself for the heavy machine shop consisted of a loop or ring bus system. This would have served the purpose admirably at some saving in copper costs. However, it was rejected for the straight-line wiring plan shown in the accompanying drawings, because the latter was better suited to the service requirements.

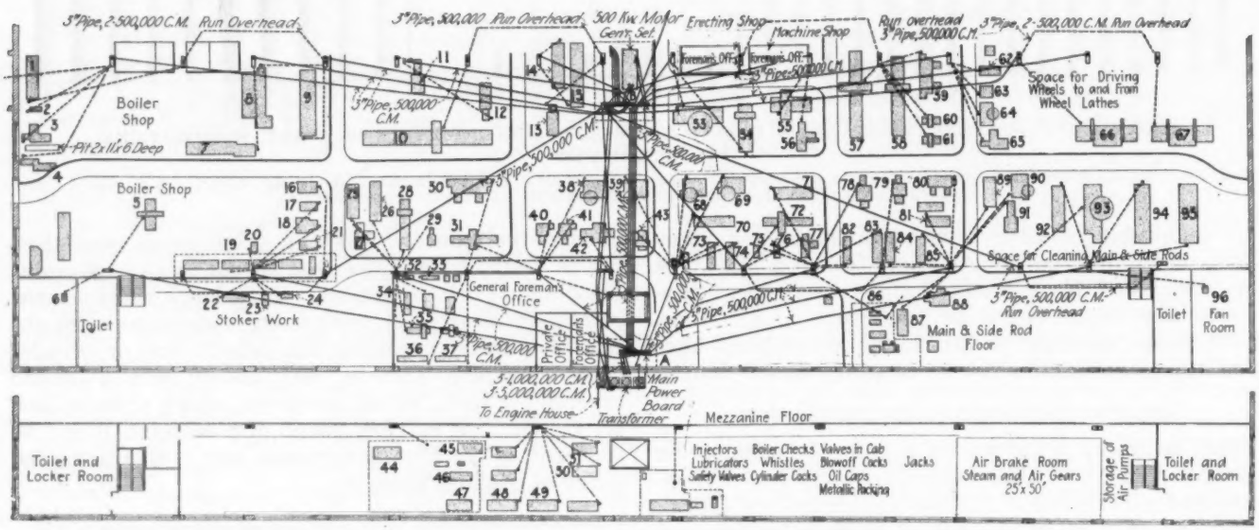


FIG. 1—POWER DISTRIBUTION SYSTEM IN THE LIGHT AND HEAVY MACHINE SHOPS
The main feeders are shown in solid lines, while the subfeeders to the machine panels are shown in broken lines. The key numbers refer to the motor-driven machines listed in the plate.

The ground area of this engine repair shop measured 600 ft. (183 m.) long by 350 ft. (107 m.) wide. Repair tracks for seventeen engines and storage space for fifty more were provided. The important sections included the machine and erecting shops, which in themselves measured 400 ft. (122 m.) long by 200 ft. (61 m.) wide, with varying heights up to 66 ft. (20 m.) An electrically operated transfer table 86 ft. (26 m.) wide alongside the erecting shop was a feature of the equipment. This table, which transfers "dead" engines to and from the repair stalls, is unique in itself because few of them used in this country are motor-driven. Man power was thought good enough until rising labor costs changed the viewpoint. Energy is taken from an overhead alternating-current No. 4/0 trolley system with a three-pole collector, the power required being 75 hp. The table travels parallel to the building and can pull an engine into or out of an erecting shop stall by means of a steel cable and sheave arrangement. Underground collector rails were considered for supplying this table, but the idea was discarded for fear of trouble from ice and snow.

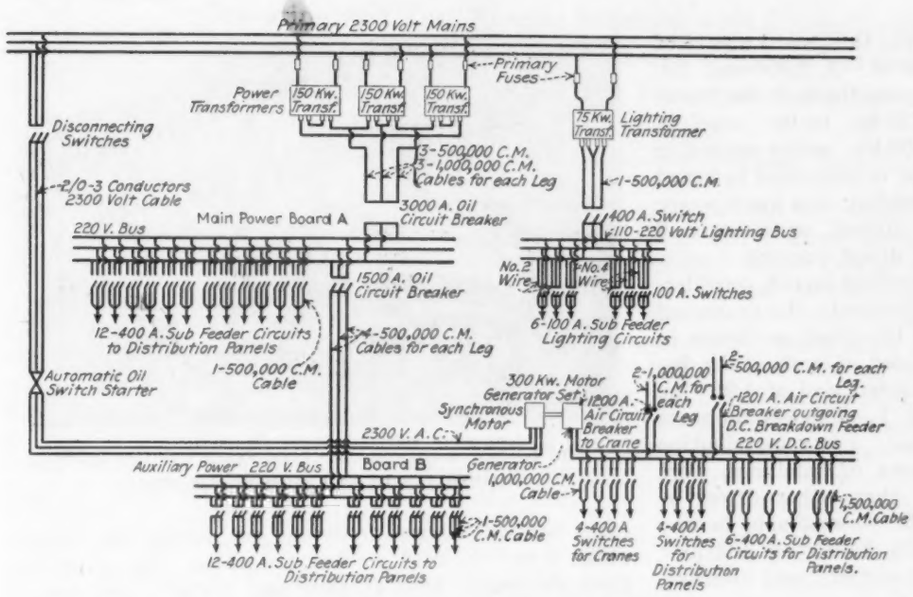

Primary 2300 Volt Mains
Primary Fuses
Power Transformers
150 Kw. Transf.
150 Kw. Transf.
150 Kw. Transf.
75 Kw. Transf.
Lighting Transformer
Disconnecting Switches
3-500,000 C.M.
3-1,000,000 C.M.
Cables for each Leg
1-500,000 C.M.
2/0-3 Conductors 2300 Volt Cable
3000 A. Oil Circuit Breaker
Main Power Board A
400 A. Switch
110-220 Volt Lighting Bus
220 V. Bus
No. 2 Wire
No. 4 Wire
1500 A. Oil Circuit Breaker
100 A. Switches
6-100 A. Sub Feeder Lighting Circuits
12-400 A. Sub Feeder Circuits to Distribution Panels
4-500,000 C.M. Cables for each Leg
1-500,000 C.M. Cable
Automatic Oil Switch Starter
300 Kw. Motor Generator Set
Synchronous Motor
2300 V. A.C.
2-1,000,000 C.M. for each Leg
1200 A. Air Circuit Breaker to Crane
2-500,000 C.M. for each Leg.
1201 A. Air Circuit Breaker outgoing D.C. Breakdown Feeder
220 V. D.C. Bus
Auxiliary Power 220 V. Bus
Board B
Generator
1,000,000 C.M. Cable
1-500,000 C.M. Cable
4-400 A Switches for Cranes
4-400 A Switches for Distribution Panels
6-400 A. Sub Feeder Circuits for Distribution Panels.
1,500,000 C.M. Cable
12-400 A. Sub Feeder Circuits to Distribution Panels

FIG. 2—SIMPLIFIED WIRING DIAGRAM

Two main boards, *A* and *B*, are connected by 220-volt leads. The 500-kw. motor-generator set is connected ahead of the transformers through disconnecting switches and an automatic oil starting switch. In connecting boards *A* and *B* four three-phase lines have been paralleled. Each phase, therefore, has an equivalent of 2,000,000 circ.mil.

In making the layout for the wiring it was necessary to provide for both direct and alternating-current motors and to allow for sufficient flexibility to take care of any changes in locations or additions of machines. Direct current was decided upon for some motors on account of the fine speed control needed for certain machines.

Three-phase, 60-cycle, 220-volt alternating-current and 220-volt, two-wire direct circuits were selected for the power service. For lighting service 110/220-volt, three-wire, single-phase energy was decided upon because it was easy to balance the lighting load and because it was desired to get economical distribution and yet produce a voltage drop of not more than 1 per cent from the distributing panels to any one outlet and not more than 2 per cent from the main board to the panels. Two power switchboards rather than one were recommended because of the added convenience of two in case of trouble and also because of the saving in copper feeders. These two boards are installed at the future load centers of the shop, which in this case happen also to be the centers of the building areas.

The supply-line voltage—2,300—is stepped down to 220 volts for delivery to switchboard *A* (Fig. 2) through

RATINGS OF MOTORS USED IN MAKING FEEDER LAYOUT IN LOGANSPORT SHOPS OF THE PENNSYLVANIA RAILROAD

No.	Machine	Hp. of Motors—Alternating Current	Hp. of Motors—Direct Current
1	4-ft. special drill presses	...	20
2	One drill press	1	....
3	5-ft. radial drill press	15	....
4	Horizontal punch	5	....
5	Punch and shears	7½	....
6	Flanging equipment	20	....
7	Rolls for 12-in. sheet	60	....
8	42-in. car-wheel lathe	...	40
9	54-in. x 20-in. lathe	...	35
10	60-in. x 60-in. x 30-ft. planes	...	5–35
11	20-in. crank slotter	10	....
12	6-ft. 4-in. radial drill	7½	....
13	18-in. slotter	...	10
14	22-in. x 14-in. lathe	7½	....
15	24-in. x 20-ft. lathe	15	....
16	Large pipe cutter and threader	...	10
17	Pipe cutter and threader	2	....
18	Bolt-thread machine	7½	....
19	Group of four 18-in. and 16-in. lathes	10	....
20	4-in. lathe	3	....
21	Unit thread machine	10	....
22	18-in. x 8-ft. lathe	5	....
23	Drill press	1	....
24	Bolt-cutting machine	½	....
25	24-in. x 10-ft. lathe	15	....
26	24-in. x 10-ft. lathe	15	....
27	5-ft. radial drill press	15	....
28	48-in. boring mill	7½	....
29	10-in. vertical shaper	3½	....
30	22-in. traverse and crank shaft	...	7½
31	34-in. x 11-ft. planer	20	....
32	Grinder	2	....
33	Grinder	5	....
34	Tool-room machine	10	....
35	20-in. shaper	5	....
36	16-in. x 8-ft. lathe	...	11½
37	16-in. x 8 ft. lathe	...	11½
38	53-in. boring mill	15	....
39	42-in. boring mill	15	....
40	20-in. stroke shaper	5	....
41	20-in. stroke shaper	15	....
42	36-in. drawout shaper	...	10
43	Milling machine	5	....
44	Group No. 5 lathe and grinding wheels	7½	....
45	16-in. x 6-ft. turret lathe	3	....
46	16-in. x 6-ft. turret lathe	3	....
47	16-in. x 6-ft. turret lathe	3	....
48	16-in. x 6-ft. turret lathe	3	....
49	16-in. x 6-ft. turret lathe	3	....
50	16-in. x 6-ft. turret lathe	3	....
51	16-in. x 6-ft. turret lathe	3	....
52	Group No. 4 buffing wheels and lathe	5	....
53	96-in. boring mill	15	....
54	50-in. horizontal boring mill	7½	....
55	Slab milling machine	50	....
56	5-ft. radial drill press	15	....
57	48-in. x 48-in. x 20-ft. planer	...	5–25
58	36-in. x 36-in. x 18-ft. planer	...	15
59	Traverse crank shaper	...	7½
60	32-crank planer	...	15–2
61	32-crank planer	...	15–2
62	Heavy-duty drill press	20	....
63	Vertical hydraulic press	7½	....
64	42-in. boring mill	15	....
65	5-ft. radial drill press	15	....
66	90-in. drive-wheel lathe	...	50–8½
67	90-in. drive-wheel lathe	...	50–8½
68	42-in. boring mill	15	....
69	42-in. boring mill	15	....
70	24-in. x 12-ft. lathe	10	....
71	30-in. x 12-ft. lathe	20	....
72	36-in. x 12-ft. planer	...	15
73	18-in. x 8-in. lathe	5	....
74	18-in. x 8-in. lathe	5	....
75	Small drill press	1	....
76	Small drill press	1	....
77	4-ft. radial drill press	...	10
78	32-in. draw-cut shaper	7½	....
79	Draw-cut shaper	...	10
80	20-in. crank shaper	5	....
81	Heavy-duty drill press	20	....
82	Lathe	5	....
83	Lathe (20-in. x 10-ft. lathe)	10	....
84	Lathe (20-in. x 10-ft. lathe)	3	....
85	11-ft. lathe	5	....
86	Group No. 3 lathes, polishing wheels	5	....
87	Polishing machine	3	....
88	Boring mill	5	....
89	24-in. x 8½-ft. turret lathe	3	....
90	42-in. boring mill	15	....
91	Slotter	10	....
92	22-in. x 14-ft. lathe	15	....
93	100-in. boring machine	...	25
94	Driving wheel press	15	....
95	Quartering machine	3–3	....
96	Fan	20	....
97	Transfer table	75	....
98	250-ton crane	...	450
99	Four 10-ton cranes—each	...	50
	Total	823	1129

a 450-kw. transformer bank. From this board a part of the load is transferred to board *B*. A 2,300-volt No. 4/0 cable feeder, which does not pass through the transformer, goes directly to the 729-hp. motor panel in switchboard *B* provided for a 500-kw. motor-generator set. The direct-current generator is connected to board *B* for distribution. Board *A*, therefore, is a main power board carrying only alternating current, while board *B* distributes both alternating and direct current.

From a detailed study of the machine layout, considering both present and future requirements, the connected motor load was determined and tabulated as shown in the table. This information was used in locating the distributing panels. The total connected load of 1,952 hp. was distributed as shown in Fig. 1. The key numbers refer to numbers on the machines. Forty distribution panels, each serving a certain area of machines, were finally decided upon. In order that either direct or alternating current service might be available in any part of the shop, the distributing panels on alternate building columns were for direct-current and alternating-current circuits respectively.

Feeders were placed in straight conduit runs in the concrete floor slabs, each 12 in. (30 cm.) to 18 in. (45 cm.) thick and covered by 3-in. (8-cm.) wood-block flooring. If conduit must be added for future machines not contemplated when the original design was made, the runs can be laid by taking up the block flooring, chasing the concrete floor slab and replacing the blocks. In making these feeder runs 1,000,000-circ.-mil cable was the maximum size used. In general it was endeavored to hold the size to 500,000 circ.mils because the larger cables are difficult to handle.

In mounting the panels on the building columns the

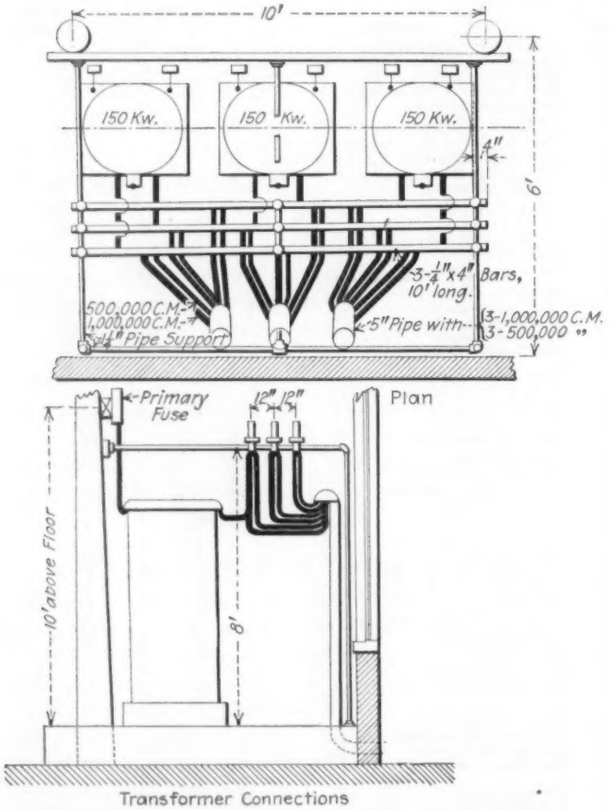


FIG. 3—DETAILS OF TRANSFORMER CONNECTIONS

In order to reduce the size of the single conductors the leads to switchboard *A* have been made up of six wires with two sets for each phase and the paralleling of three three-phase lines.

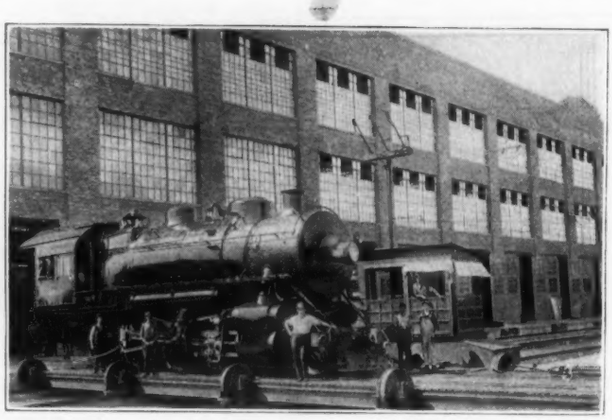


FIG. 4—MOTOR-DRIVEN TRANSFER TABLE USED TO MOVE LOCOMOTIVES TO AND FROM REPAIR STALLS

panel box was allowed to extend out beyond the column about 6 in. (15 cm.) so that the gutter was accessible from the rear. This arrangement permits easy access to the panel through conduits coming from three directions. These panels were equipped with lugs at the top of the buses which permitted connection to panels on floors above without running extra circuits from the switchboards.

The entire job, was built by the Austin Company at a cost of $1,200,000, of which about $100,000 was for the electrical work. Power for operating this installation is taken from the Logansport municipal generating station, but there is in addition to this service an emergency feeder connected with an old power house of the Pennsylvania Railroad Company. This is made through a reverse current circuit breaker for the protection of the generator in the old power house. At the present time 450 kw. in transformers take care of the alternating current load, but in the future 950 kw. will be required.

Water Power Development in Uruguay

AN ERA of development in the Republic of Uruguay, South America, appears to be at hand, according to a recent report by W. W. Ewing, United States trade commissioner. The most interesting of the projects under consideration is that for an international power plant to be erected on the Uruguay River by Argentina, Brazil and Uruguay jointly, with guarantees for the equitable distribution of power to the three counties concerned. On the site being considered it is calculated that 2,500,000,000 kw.-hr. a year could be developed and distributed within a radius of 375 miles. The project contemplates the construction of two dams, one movable and one fixed, with canals to the power plant. It will utilize a fall of 77 ft. (22 m.). The installation would also open for navigation 419 miles (674 km.) of river which today are inaccessible and would permit the inundation of adjoining zones which are suitable for agriculture.

Other projects for the development of water power are also being considered by private persons and corporations. Notwithstanding the abundant water power in Uruguay, nothing hitherto has been done to develop it for irrigation or power purposes, and the opportunities now opening for investment are held to be promising.

Burning Low-Grade Coals of the Southwest

Operating and Test Results Attained with Chain-Grate Settings of Different Types—Recommendations for Companies Using the Fuels Available—Analyses of Several Varieties of Southwestern Coals.

By W. M. PARK

Construction Engineer Green Engineering Company, East Chicago, Ind.

PRODUCTION of coal in the Southwestern fields of the United States has not kept pace with that of Eastern fields, owing to the smaller demand. This demand is effected by the extensive oil developments of that section and by the lesser density of population and fewer manufacturing enterprises. The quality of coal in this region varies from a good grade of anthracite containing 14,000 B.t.u. to low lignite of 6,000 B.t.u. The anthracite field, which is in New Mexico, is of limited area and is mentioned merely to indicate the contrast in fuel quality found in small radius. The majority of the fuels of the Southwest contain ash in excess of 15 per cent and are of a composition that fuses readily into a sticky clinker. During the last eight years furnace design has developed beyond the experimental stage, however, and engineers can rationally design furnaces to use these fuels with the same assurance of ultimately satisfactory results that is felt when designing furnaces for Eastern coals. This article will describe a few modern settings with which creditable performance has been secured.

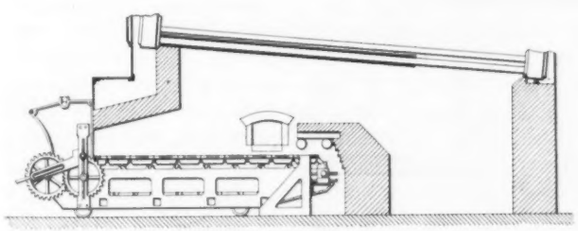


FIG. 1—TILE INCLOSING LOWER TUBES HELPS MAINTAIN HIGH FURNACE TEMPERATURES

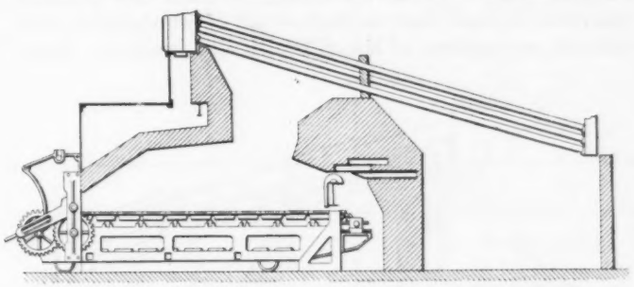


FIG. 2—EXPERIMENTAL FURNACE SUCCESSFUL IN BURNING SEMI-ANTHRACITE COAL

Fig. 1 shows a horizontal-pass boiler with a chain-grate stoker having a ratio of grate area to heating surface of 1 to 52, which readily ignites and burns 40 lb. of coal hourly per square foot (195 kg. per sq.m.) of grate area and which under test conditions readily gave 72 per cent efficiency when burning a northwestern New Mexico coal of the following analysis:

Moisture, per cent	17.0
Volatile, per cent	33.0
Fixed carbon, per cent	33.0
Ash, per cent	17.0
B.t.u., commercial basis	8,500

The higher grade coals of New Mexico are used quite extensively in El Paso, Tex., on a number of chain-grate installations. All of these coals are rich in volatile gas and some appear to contain, either in the volatile matter or in the lighter particles of ash, some element which attacks even the best grades of firebrick if the furnaces are so designed that high velocity of gas results.

A furnace for a vertically baffled boiler is represented in Fig. 3. The outstanding features of design are the ample combustion chamber provided by setting the boiler 11.5 ft. (3.5 m.) under the front header, the high set and steeply sloped arch which in connection with the vertical bridge wall allows intense reflection and radiation of heat on the entering fuel, and a large opening between arch and bridge wall to insure nominal gas velocity. This type of furnace has given highly satisfactory performance, operating continuously at averages of 15 per cent CO_2 and ash-pit loss of 2 per cent to 3 per cent when burning northeastern and north central New Mexico coals with the following analysis:

Moisture, per cent	2.87
Volatile, per cent	34.27
Fixed carbon, per cent	46.08
Ash, per cent	16.78
B.t.u., commercial basis	12,023

About 60 miles (100 km.) west of Fort Worth, Tex., is an isolated bituminous coal field of small area. The screened lump grades of this coal have a heating value of 12,500 B.t.u., and a large percentage of the output is used by the Texas & Pacific Railway, leaving a limited amount for domestic consumption in a territory traversed by this railroad. The screenings are burned on chain-grate stokers at several of the mine plants and at a large public service plant in Forth Worth. The better grades of screenings have a heating value of 10,500 B.t.u., while the lower grades run as low as 8,300 B.t.u. and have a proximate analysis of:

Moisture, per cent	3.50
Volatile, per cent	30.70
Fixed carbon, per cent	26.24
Ash, per cent	39.56

To burn this coal successfully it is necessary to cover approximately 90 per cent of the furnace with an arch set with a steep slope and ample height which in combination with a vertical bridge wall will cause intense reflection of heat upon the fuel bed at the entrance to the furnace. Such a furnace is shown in Fig. 4. Naturally, it is also necessary to provide unusually large grate surface to permit of burning large quantities of this low-grade fuel. Some of the stokers in operation at the mines have ratio of grate area to heating surface as low as 1 to 25.

In the western counties of Arkansas there is mined a

grade of coal known as semi-anthracite, having the following average analysis:

Moisture, per cent	3.5
Volatile, per cent	14.0
Fixed carbon, per cent	60.5
Ash, per cent	22.0
Bt.u., commercial basis	11,400

In regard to the glossy appearance of freshly broken pieces and the nature of the fracture this fuel is similar to Pocahontas coal. The percentage of volatile matter and moisture also approximates that of the latter fuel, but the different nature of the volatile content and the considerably higher percentage of ash give the coal characteristics in burning which are quite different from Pocahontas coal. When heated the tars appear to volatilize before they reach the temperature at which they would become plastic, in contrast with Eastern coking coal.

Instead of coking together in lumps, the smaller chunks disintegrate under heat so that the fuel bed is like a mass of loose sand. Because the coal has these characteristics it produces a dense fuel bed, and therefore the depth of fire must be less than that used with coals of high volatility for corresponding drafts and combustion rates. These low-volatility coals are perhaps the most difficult fuels to burn of all encountered in this district, on account of the difficulties of ignition. Even

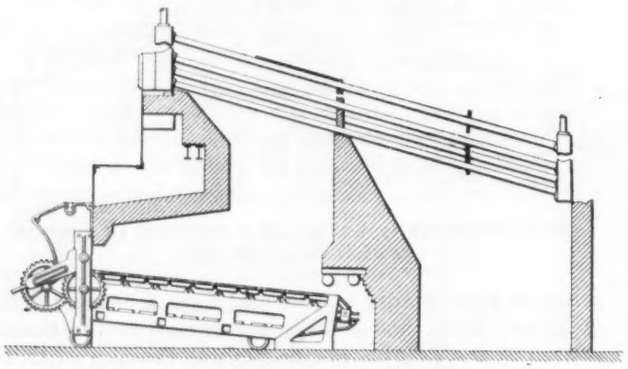


FIG. 3—FEATURES OF THIS DESIGN ARE AMPLE COMBUSTION CHAMBER, HIGH STEEP ARCH, LARGE GAS OUTLET

with the furnaces designed for the most intense concentration of heat at the ignition point, semi-anthracite coals will ignite only on the surface if radiant and reflected heat alone are depended upon. The ignition of fuel in the lower part of the fuel bed can be accelerated by use of a special gate having corrugated face tile in contact with the fuel.

ANALYSES OF SIX VARIETIES OF COAL

Name of Coal	Gallup, N. Mex.	Raton, N. Mex.	Strawn, Tex.	Dewar, Okla.	Jenny Lind, Ark.	Huntington, Ark.
Moisture	19.55	2.45	2.81	6.27	4.25	3.88
Volatile content	69.53	34.99	35.41	27.93	14.28	16.93
Fixed carbon	.....	46.08	40.23	46.37	58.89	56.06
Ash	10.92	16.48	21.55	19.43	22.58	23.13
B.t.u. per lb. as fired	8,367	12,059	11,200	10,706	10,874	10,912
Percentage of combustible in refuse	.....	15.9	22.3	26.9	22.9	19.8
Furnace draft	0.27	0.12	0.11	0.23	0.27	0.38
Flue gas temperature	584	507	477	520	463	444
CO_2 at furnace	15.5	15.6	12.2	12.6	13.5	12.4
CO_2 at uptake	10.0	11.7	9.7	10.0	12.9	11.6
Coal burned hourly per square foot	40.2	26.6	24.65	27.5	32.1	28.5
Per cent builder's rating developed	146	154	134	139	170	148
Combined efficiency	71.8	72.8	73.6	71.7	74.1	72.2

Fig. 2 shows an experimental design of furnace first worked out in connection with semi-anthracite coal-burning problems. It involves an expensive lot of special tile shapes, and the maintenance of the brickwork is high.

Equally good results may be expected with a simpler type of arch shown in Fig. 3, though for the boiler and for the length of stoker shown in Fig. 2 the furnace projection and length of arch should be increased when the reversed arch is eliminated.

From a long series of tests of from eight hours to twenty-four hours' duration, six are presented in the accompanying table. Efficiencies as high as 78.5 per cent were obtained where unusual pains were taken to maintain steady conditions, but the list chosen does not include the maximum results. Tests typical of results readily obtainable are of greater value to the engineer, and this point was borne in mind in making the selection.

The writer's experience in burning the Southwestern coals leads to the following conclusions:

1. On account of the high ash content and fusible nature of their ash, these coals can be burned with highest efficiency and with least labor by use of a chain grate.

2. Most of the coals are of high volatile content, ignite readily and burn freely if provided with long, high-set arches.

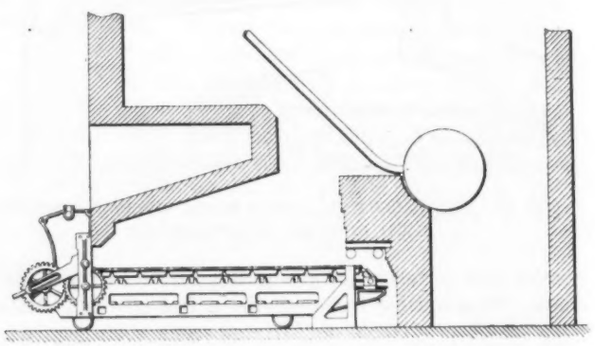


FIG. 4—HIGH STEEP ARCH COVERS ABOUT 90 PER CENT OF FURNACE. THIS WITH VERTICAL BRIDGE WALL CAUSES INTENSE HEAT REFLECTION

3. Semi-anthracite coal ignites least readily, but if load conditions permit maintenance of steady furnace conditions, this fuel can be burned with high efficiency. Good overload also is possible to secure with liberal grate area.

4. As semi-anthracite crumbles in the fire rather than coking together, it is desirable to reduce sifting of the fuel and resulting holes in the fire by the use of a stoker chain which has finally divided and ample air space.

5. To secure high furnace efficiency at high rating a large furnace volume is desirable. This is insured by setting horizontal water-tube boilers at a front header height of 8 ft. to 10 ft. (2.4 m. to 3 m.) if horizontally baffled and 10 ft. to 13 ft. (3 m. to 4 m.) if vertically baffled.

6. Provision should be made for furnace draft of 0.30 in. to 0.60 in. (7.6 mm. to 15.2 mm.), and liberal grate area should be furnished to insure good overload capacity when burning the medium and lower grades of these coals.

Calculating Substation Short Circuits—II

The Problem of Placing Reactance to Best Advantage in the 2,300-Volt Bus Is Considered—Several Feeder Arrangements Are Investigated for Getting Maximum Protection at Minimum Expense

By R. F. GOODING

A SYSTEM composed of generating plants and a substation was specified in the first part of this article, published in the ELECTRICAL WORLD April 3. This system was investigated to determine the reactance required in the high-tension bus system to keep short-circuit energy within control. With the high-tension bus taken care of, the next step is to consider conditions on the low-tension or 2,300-volt bus. First the bus or transformer reactance should be placed to the best advantage, and then various methods for avoiding the use of a heavy-duty breaker in each of the feeder circuits must be taken up. Several typical feeder arrangements are proposed, and the merits of each are considered.

For this study we shall assume three transformer banks, each rated at 6,000 kva., 13,200/2,300 volts, with a reactance of 5 per cent. (See Fig. 5 for arrangement.) When only one bank is operating, the equivalent power on the 2,300-volt bus is 100,000 kva., at 100 per cent reactance. The power on the 13,200-volt bus is 100,000 kva., at 16.2 per cent reactance, and this, added to the reactance of the transformer bank, 5 per cent at 6,000 kva. (83.3 per cent at 100,000 kva.), gives 99.7 per cent (say 100 per cent) reactance at 100,000 kva., as the power delivered to the 2,300-volt bus. 100,000 kva., at 100 per cent = 100,000 kva. = 25,000 amp. Table VI gives results for one, two and three banks.

The first scheme to consider for reducing this current will be to introduce extra reactance in the transformer circuits, and 3 per cent reactance will be added, making the total reactance of each transformer circuit 8 per cent at 6,000 kva. Then, using the same method of calculation as just described, with one bank operating we get 66,000 kva. = 16,500 amp. in case of a short circuit. Values for one, two and three banks are given in Table VII.

A reduction from 56,500 amp. to 41,000 amp. will help things very materially, but 41,000 amp. is still too high for the average 2,300-volt breakers, so a further reduction will be necessary. This time 5 per cent external reactance will be tried, making the total reactance of the circuit 10 per cent. (See Table VIII.)

A rupturing duty of 35,000 amp. is still too high for the 2,300-volt breakers we should expect to see used on a 2,300-volt distribution system, so a 10 per cent reactance will be tried—total reactance of each circuit 15 per cent. (See Table IX.)

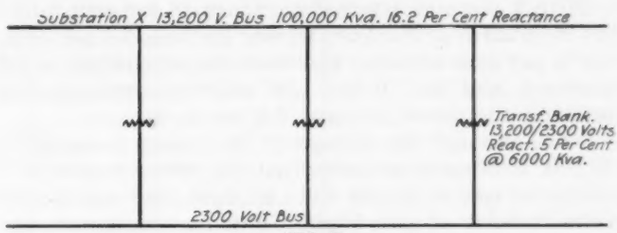

Substation X 13,200 V. Bus 100,000 Kva. 16.2 Per Cent Reactance
Transf. Bank. 13,200/2300 Volts React. 5 Per Cent @ 6000 Kva.
2300 Volt Bus

FIG. 5

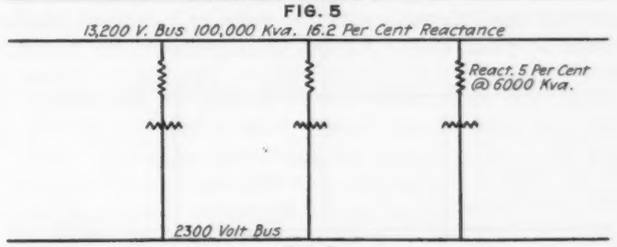


FIG. 6

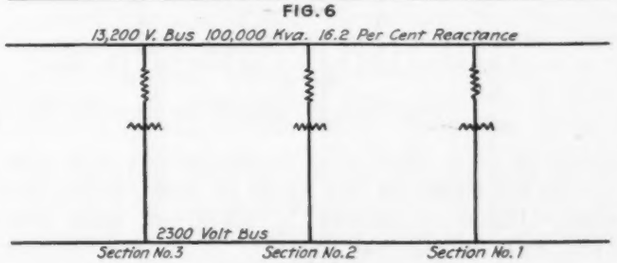


FIG. 7

FIGS. 5, 6 AND 7—SCHEMES OF REDUCING THE ENERGY DEVELOPED AT THE BUS BY SHORT CIRCUITS

It must be remembered, however, that while additional reactance will reduce the short-circuit currents, it will also make the voltage regulation on the bus that much worse, and this factor may decide how much reactance can be used. The regulation of a

TABLE VI—2,300 VOLT BUS, NO EXTERNAL TRANSFORMER REACTANCE

Transformer Banks Operating	Equivalent Reactance at 100,000 Kva. (Per Cent)	Short Circuit, Kva.	Short Circuit, Amp.
1	100	100,000	25,000
2	57.7	173,000	43,000
3	44	226,000	56,500

TABLE VII—2300-VOLT BUS, 3 PER CENT. EXTERNAL REACTANCE

Banks Operating	Equivalent Reactance at 100,000 Kva. (Per Cent)	Short Circuit, Kva.	Short Circuit, Amp.
1	150	66,000	16,500
2	83	120,000	30,000
3	61	164,000	41,000

TABLE VIII—2,300-VOLT BUS, 5 PER CENT. EXTERNAL REACTANCE

Banks Operating	Equivalent Reactance at 100,000 Kva. (Per Cent)	Short Circuit, Kva.	Short Circuit, Amp.
1	183	54,600	13,500
2	100	100,000	25,000
3	72	139,000	35,000

TABLE IX—2,300-VOLT BUS, 10 PER CENT EXTERNAL TRANSFORMER REACTANCE

Banks Operating	Equivalent Reactance at 100,000 Kva. (Per Cent)	Short Circuit, Kva.	Short Circuit, Amp.
1	266	37,800	9,400
2	141	71,000	17,800
3	100	100,000	25,000

transformer can be arrived at approximately from the formula

$$\text{Regulation} = X \sin \theta + R \cos \theta$$

where X = reactance and R = resistance, in per cent, and θ = phase angle. All the calculations made here will be for 80 per cent power factor when $\sin \theta = 0.6$ and $\cos \theta = 0.8$. For transformers of this size (3 — 2,000 kva. units per bank) R may be assumed as 0.75 per cent. Then, with no external reactance in the circuit, the regulation of a bank would be:

$$\begin{aligned}\text{Regulation} &= X \sin \theta + R \cos \theta \\ &= 5\ (0.6) + 0.75\ (0.8) \\ &= 3 + 0.6 \\ &= 3.6 \text{ per cent.}\end{aligned}$$

With 3 per cent external reactance (8 per cent total) the regulation of the transformer becomes 5.4 per cent, for 5 per cent external reactance the regulation is 6.6 per cent, and for 10 per cent external reactance the inherent regulation becomes 9.6 per cent.

Now, although the voltage of the system is normally 13,200, it is quite probable that the power station bus would be run at 13,500 volts at light load and 13,800 volts at heavy or peak load. These may be assumed to give at the substations 13,200 volts at light and 13,500 volts at peak load. As the transformers are 13,200/2,300-volt ratio, the normal no-load or light-load voltage on the 2,300-volt bus would be 2,300, with 2,350 volts—(13,500 ÷ 13,200) × 2,300)—at peak load. Then with no external reactance in the transformer circuit and a regulation of 3.6 per cent, this would give 2,350 — 3.6 per cent = 2,265 volts. With a normal no-load voltage of 2,300 this means an actual variation of only 35 volts, or 1½ per cent.

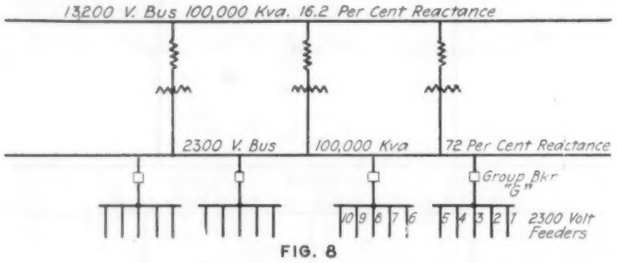


FIG. 8

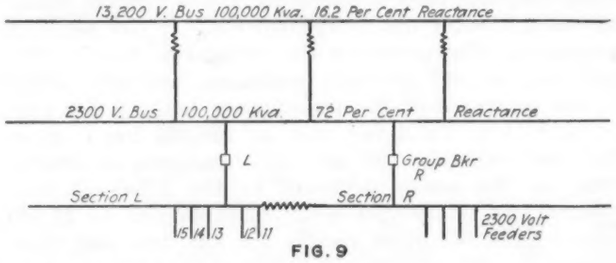


FIG. 9

FIGS. 8 AND 9—METHODS OF REDUCING THE USE OF HEAVY-DUTY BREAKERS ON EACH FEEDER

With 3 per cent external reactance in transformer circuit (8 per cent total) and a corresponding regulation of 5.4 per cent, the actual full-load voltage would be 2,223 volts. This gives a variation from no-load to full load of 77 volts, or 3.35 per cent. When the total reactance is 10 per cent (5 per cent external) and regulation 6.6 per cent the full-load bus voltage will be 2,195 volts—a variation from no-load voltage of 105 volts, or 4.6 per cent. Similarly, a 10 per cent external reactance gives a regulation of 9.6 per cent and a full load bus voltage of 2,125 volts—a variation of 175 volts, or 7.6 per cent.

High External Reactance Makes Good Regulation Difficult

A variation in bus voltage of 7.6 per cent might be permissible, if all of the load were right in the substation. This, however, would rarely be the case, and to this 7.6 per cent drop would have to be added the drop due to long cable runs. This could easily amount to 2 or 3 per cent, so the ultimate consumer would have to put up with a voltage drop of at least 10 per cent. Feeder regulators would eliminate this difficulty, but in this discussion it is desirable to consider only the inherent characteristics of the circuits. Therefore the question of 10 per cent external reactance will be disregarded, and all subsequent calculations will be based on an external reactance of 5 per cent in the transformer circuits, as shown in Fig. 6.

On the basis, then, of 10 per cent total reactance in each transformer circuit and three banks operating, the equivalent power on the 2,300-volt bus will be 100,000 kva., at 72 per cent. (See Table VIII.) This gives at short circuit 139,000 kva. = 35,000 amp. According to the curves already mentioned (A. I. E. E., 1918), a breaker opening in 0.4 second on a circuit with 72 per cent reactance would have to rupture approximately 1.37 times full-load current. In this case this would give 137,000 kva. But the total kva. was found to be only 139,000, so the breaker would have to rupture practically the entire initial short circuit.

Very few central stations would care to equip each 2,300-volt feeder with a breaker capable of rupturing 35,000 amp., so measures must be taken to reduce this value to allow the use of cheaper breakers. Probably the first suggestion to do this would be to have a sectionalized 2,300-volt bus, as shown in Fig. 7 on the preceding page.

With a bus reactance of 5 per cent at 6,000 kva. (83.3 per cent at 100,000 kva.) the power delivered to each bus section by its own bank would be 100,000 kva. at 183 per cent reactance (the same as the total power on the bus with only one bank operating). Then total power on, say, the right-hand section (No. 1) would be:

		Kva.	Per Cent Reactance
Power on section 3	=	100,000	183
Bus reactance (6,000 kva., 5 per cent)	=	100,000	83
Power section 3 to section 2	=	100,000	266
	=	69,000	183
Power section 2	=	100,000	183
Total power section 2	=	169,000	183
	=	100,000	108
Bus reactance (6,000 kva., 5 per cent)	=	100,000	83
Power section 2 to section 1	=	100,000	191
	=	96,000	183
Power section 1	=	100,000	183
Total power section 1	=	196,000	183
	=	100,000	93

100,000 kva. at 93 per cent reactance = 107,000 kva. = 27,000 amp.

Power on section 3 would be the same as for section 1.

The power on section 2 would be greater than on either section 1 or section 2. Sections 1 and 2 would each deliver to it 100,000 kva. at 266 per cent reactance = 69,000 kva. at 183 per cent reactance. Then:

		Kva.	Per Cent Reactance
Power section 1 to section 2.....	=	69,000	183
Power section 2.....	=	100,000	183
Power section 3 to section 2.....	=	69,000	183
Total power section 2.....	=	238,000	183
	=	100,000	77

100,000 kva. at 77 per cent reactance
= 130,000 kva. = 32,500 amp.

Table X gives results using 5 per cent and 10 per cent bus reactances, the values given being for section 2.

TABLE X—2,300-VOLT BUS, SECTIONALIZED BUS

Bus-Sectionalizing Reactance	Equivalent Reactance at 100,000 Kva. (Per Cent)	Short Circuit, Kva.	Short Circuit, Amp.
5 per cent at 6,000 kva.	77	130,000	32,500
10 per cent at 6,000 kva.	81	124,000	31,000

As shown in Table X, a bus-sectionalizing reactance does not reduce the short-circuit current very greatly, a 10 per cent reactance causing a reduction of only 4,000 amp., so the value is still too high for the

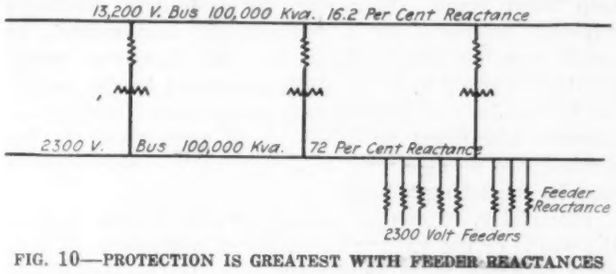


FIG. 10—PROTECTION IS GREATEST WITH FEEDER REACTANCES

2,300-volt breakers usually applied on such feeders. The introduction of more reactance would bring this value down lower, but would have the disadvantage of producing unequal voltages on the 2,300-volt bus sections when the sections have unequal loads.

ADVANTAGES OF GROUPING FEEDERS

Another way of reducing the short-circuit current on the feeder breakers is to divide these feeders into groups of, say, five each, having for each group a breaker capable of rupturing the full short-circuit current. These breakers would be so wired that a short-circuit on feeder 1 would trip the group breaker instantaneously. The breaker on feeder 1, however, would not trip until the group breaker was out. Then the tripping of the feeder breaker would reclose the group breaker, restoring voltage to the other breakers of the group. The operation (see Fig. 8) would be:

1. Short circuit on feeder 1.
2. Group breaker *G* trips instantaneously.
3. Feeder breaker trips.
4. Group breaker *G* recloses.

This arrangement would cause a slight interruption to the four good feeders in this group, but as it would last for only two seconds or less, this would not be a very serious difficulty. However, it has this decided advantage: If there are twenty feeders, it would require only four heavy-duty breakers, and the actual feeder breakers, being required to break no current, could be of an inexpensive type. A possible objection to this scheme might be that in case of trouble in the group breaker itself the whole group would be out of commission. If conditions warrant the extra precaution, an extra breaker could be installed for each group. The two breakers to each group could then be interlocked, either mechanically or electrically, so only one could be used at a time. The wiring scheme for this group arrangement will be considered in a later article under the subject of "Relays."

TWO-BUS SCHEME SAVES EXPENSIVE BREAKERS

Still another possible scheme would be to have two 2,300-volt buses, the second one to be sectionalized as shown in Fig. 9, and all of the feeders supplied from this bus. With this scheme a short circuit on a feeder supplied from the left-hand bus section would instantly trip the breaker supplying it. Then the breaker feeding the right-hand section would have to supply power to section *L* over the bus reaction, and the feeder breaker would rupture this current instead of the entire short-circuit current. The sequence for this arrangement would be: (1) Short circuit on feeder 13; (2) breaker *L* trips instantaneously; (3) feeder breaker 13 trips; (4) breaker *L* recloses.

If the bus reactance be 10 per cent at 6,000 kva., the amount of power that section *R* could force through the bus reactance into the fault would be 100,000 kva. at 239 per cent reactance. (The power on the 2,300-volt bus is 100,000 kva. at 72 per cent reactance, and this added to the bus reactance of 6,000 kva. at 10 per cent or 100,000 kva. at 167 per cent gives this figure.) This would give a short circuit 44,000 kva. = 11,000 amp. If the bus reactance be increased to 20 per cent at 6,000 kva., this figure is reduced to 24,600 kva. = 16,100 amp., while a 40 per cent reactance will bring it down to 13,600 kva. = 3,400 amp.

While this scheme would require only two heavy-duty breakers, it would require the bus reactances which would practically offset the cost of the extra group breakers. A more serious point, however, is that a short circuit on a feeder would reduce the voltage of all other feeders on that particular bus section, due to the fact that all of the power would have to come through the bus reactance. In the scheme just previous to this, the only other feeders to be affected would be the four in the same group. The question to be decided then is whether to trip four feeders for one second to two seconds or to have reduced voltage on *all* feeders for the same length of time. This would very probably be decided in favor of the group system as against the one with the sectionalized bus.

Last of all, to reduce the feeder short circuits, we can put a reactance in each feeder as per Fig. 10. In this location they do the most good, but at the same time this arrangement takes the greatest number of reactors. This means increased cost of reactors and increased cost of bus structure, building, etc.

Assume the feeders to be 250-amp. capacity, 1,000 kva. per circuit. The equivalent power on the bus is 100,000 kva. at 72 per cent reactance. A feeder reactance of 1 per cent at 1,000 kva. would give 100,000 kva. at 172 per cent reactance as the power of the feeder. This gives 58,000 kva. = 14,500 amp. as the duty on the feeder breaker. Increasing the reactance to 2 per cent gives 37,000 kva. = 9,250 amp., and a 3 per cent reactance would give only 27,000 kva. = 6,750 amp. as the duty on the breaker.

It must be borne in mind that added reactance, while it reduces the short circuit, also means poorer voltage regulation for the customer. These two points must be considered, as well as cost, and an attempt must then be made to strike a happy medium.

Readers' Views and Comments

The Tariff on Research

To the Editor of the ELECTRICAL WORLD:

SIR: Your editorial in the March 20 issue, page 643, referring to the tariff bill on scientific apparatus now pending before the Senate, is most timely. If anything is to be done to remove some of its objectionable features, it must be done at once, and your criticisms point very plainly the direction which improvement should take. The writer believes sincerely in the protection of American industry, particularly at this time of industrial disturbances all over the world and in view of the very serious conditions which are disclosed by the sudden stress of war. We in this country had so long complacently imported technical material from Germany that the failure of supply was a grievous shock to our sensibilities. The proposed tariff will at least give continued encouragement to American makers in following the path along which necessity has led them. In amount the tariff proposed is substantially that in force before the war, except that it now covers some items, like raw optical glass, previously on the free list. For that matter it certainly would be a crime to let the optical-glass industry, which made such admirable progress in time of need, die from inanition due to free importation.

The chief feature of the present bill is that it throws the burden of tariff upon the educational institutions previously allowed to import duty-free. Even in this particular, difference of opinion has developed in the discussions of the subject, and not a few of those interested have felt that on the whole the burden could be well borne for the sake of bringing American manufacture of apparatus to a point where it would prove a dependable and convenient source of supply.

The matter of duty on apparatus not made in this country, to which you have referred, is one which certainly should be very thoroughly considered by the Senate before final action is taken. There are many items, not specific but generic, practically unobtainable from American sources—for example, polarizing apparatus of all kinds, surveying aneroids, direct-vision spectroscopes, a few types of electrical measuring apparatus and photometric devices, occasionally very useful, with not a few other things which will forcibly suggest themselves to those who have occasion to use them. A casual sample of any of these may have at some time been made in the United States, but so far as the writer has discovered they are not obtainable from stock as the regular product of any American maker. It certainly would be just and fair to add to the pending bill a provision that apparatus of kinds not obtainable in this country through regular commercial channels should be admitted duty-free to all alike on a clear showing of this condition. The writer would go far enough to hold that such a rule should not apply to peculiar modifications of apparatus made after the pattern of some particular foreign firm or to forms held against American manufacture by the patents of foreigners. The requirement for free admission should be that a generally similar article of similar grade is not obtainable from the regular product and stock of an American manufacturer. When such items are actually put in manufacture here they should automatically have full protection, which should prove stimulus enough for our makers to go ahead on anything that is worth the effort. Meanwhile the investigator would not be burdened by a tariff which is a direct tax on research without conferring benefit on the American apparatus maker or turning more than a petty amount into the treasury.

LOUIS BELL.

Boston, Mass.

The Small Consumer and the Kilowatt-Hour

To the Editor of the ELECTRICAL WORLD:

SIR: Gas companies have one advantage over their electrical competitors in gaining the confidence of the small domestic consumer. Most persons know what a cubic foot is and can imagine a symmetrical block of illuminating gas passing through the meter and being consumed at the burners. Comparatively few know what a kilowatt-hour is. Dictionary definitions do not help them much. Moreover, an up-to-date residence schedule, prepared by a professional rate expert, in small type on the back of the bill, however neatly printed, is likely to be mentally consigned by the recipient to the abode of defunct and unrighteous Philadelphia lawyers, who alone, he thinks, could understand it. He himself has no idea what he is paying for, but is quite sure he is getting "stung."

Electricity, of course, cannot be sold by the foot or the pound or the gallon; but is it not possible to dispose of it by some name more reassuring to the electrically ignorant than "kilowatt-hour"? In Great Britain the kilowatt-hour is called a Board of Trade unit, and it is proposed to change that designation to "kelvin." Neither of these names, however, would help much, for "unit" is meaningless and "kelvin," if a little easier to memorize, is just as mysterious as "kilowatt-hour."

What is the matter with "electrical hour"? And why not, having adopted the simpler and more persuasive term, print upon the face of the bill an explanation of the following nature:

> AN electrical hour — technically called a kilowatt-hour (that is, a 1,000-watt hour) — is the amount of electricity consumed by:
>
> A 40-watt lamp in twenty-five hours.
> A 50-watt lamp in twenty hours.
> A 100-watt lamp in ten hours.
> A 550-watt flatiron in a little less than two hours.
>
> Thus a new 60-watt lamp, for instance, burning two and one-half hours a night for thirty nights will consume $60 \times 2\frac{1}{2} \times 30$ watts, which gives 4,500 watts, or four and one-half electrical hours. But calculations made in this way will not, of course, be exact enough to agree absolutely with the bill.

Then the aggrieved householder by noting the rating of his lamps and appliances and the time that each of them was burned in a given month could by a simple arithmetical process arrive at an opinion on the accuracy of his bill.

C. S. MANN.

New York City.

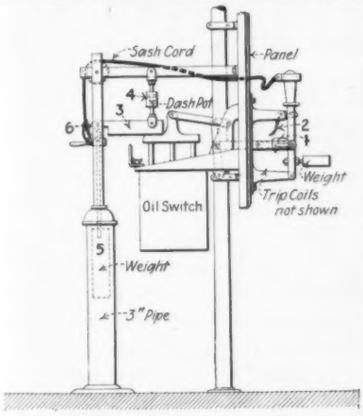
Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Device That Automatically Recloses Oil Switch After Tripping Out

AN ARRANGEMENT for automatically reclosing an oil switch which has been tripped out by overload has been developed by the Southern California Edison Company for use where an attendant is not constantly present. When a switch has been tripped this device will close the switch after the lapse of a certain interval of time which may be changed according to conditions. After the switch has reclosed once an attendant must set it before it again recloses.

The device has been designed for use in substations which have no independent source of energy, such as a storage battery, and therefore its action is entirely mechanical. The operation is as follows: The occurrence of a short circuit causes the trip coils attached to the switch mechanism in front of the panel to raise and break the toggle joint shown at (1). This toggle joint releases the trigger (2) which retains the switch handle in its vertical position. Owing to the weight attached to the switch handle it falls away from its vertical position, placing the sash cord under a slight tension. The change in the position of the switch handle permits the toggle joint again to straighten out so that the movement of the switch handle toward the panel will close the switch.



SWITCH AUTOMATICALLY RECLOSED BY DROPPING OF WEIGHT

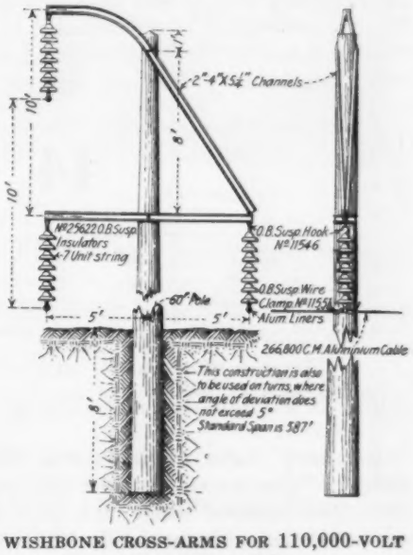
As the switch opens, the arm (3) which had previously rested upon the yoke of the oil switch is now released and begins to fall, retarded by the dashpot. When this arm has fallen a certain distance the weight (5) is released by operation of the dog (6). The fall of this heavy weight, which is hung on the sash cord, pulls the switch closed. Should the switch be reclosed when the short circuit is still on the line, the switch will trip out immediately as the automatic mechanism on the switch is not interfered with by the weight pulling on the switch handle. Before the switch can again automatically reclose the weight must be lifted to its upper position by an operator. The dashpot is introduced for the purpose of preventing too rapid reclosing after the switch has tripped out. It may be adjusted to introduce an interval of thirty seconds or so between the opening of the switch and its reclosing.

These switches have been designed by the writer particularly for use in the agricultural sections of California in small substations where the operators make inspections only daily or twice a day. Most trouble occurring in the lines is cleared up after one operation of the switch, and if it is not, the switch is an indicator to the inspector that there may be serious trouble.

J. H. STOCKBRIDGE,
Superintendent.
Southern California Edison Co.,
Los Angeles, Cal.

Single Wood Poles for Use for 100,000-Volt Line

A CREOSOTED wood pole 60 ft. (18.3 m.) in height, with double channel-iron wishbone cross-arm, has been adopted by the San Joaquin (Cal.) Light & Power Corporation for the 110,000-volt transmission line which extends from the new Kerckhoff power project to Corcoran, a distance of about 70 miles (112 km.). The same construction will be used when the line is extended this summer a further distance of about 65 miles (104 km.), making 135 miles (216 km.) in all. It has been found that two 4-in. (10.2-cm.) channels give as satisfactory results on strength tests as one 7-in. (18-cm.) channel, saving both weight and expense. The spans are long, a 587-ft. (180-m.) spacing being standard and some spans occurring as long as 700 ft. (210 m.). The same double-channel wishbone construction on a single pole was used at these long spans, and four guys were installed on each pole, two side guys and two guys with the line.



WISHBONE CROSS-ARMS FOR 110,000-VOLT WOOD POLE LINE

Wind pressure is figured at 8¾ lb. per square foot (39.2 kg. per sq.m.), and there are no ice and snow considerations, so that the factor of safety for wind is reckoned at 3.1 for maximum wind. As a matter of fact, weather bureau records for this region show no wind pressure higher than 4½ lb. per square foot (22 kg. per sq.m.) during the entire period of record. This would give a safety factor of six, which complies with all requirements. As a column, a factor of safety of about ten is figured. Sag curves are figured on the same wind pressures as given above. It has been found that

it is not advisable to dead-end on the arm because of the twisting effect which develops in the upper framework, so that all dead-ends are made vertically on the pole, except at slight angles where the line dead-ends both ways on the arm. The wishbone construction is slightly different from that of the standard wood pole in use by the company, which makes use of straight channels. In order to insure the clearance for the longer string of insulators on the high-voltage line, it was found necessary to go back to the curved form, as the straight wishbone would have had to be too long to be practicable.

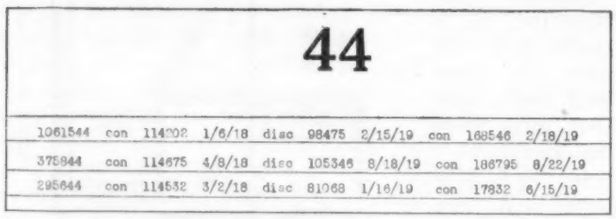
It is estimated that the money saved on wood-pole construction over steel poles is sufficient to replace the wood poles every twelve to fifteen years. As a matter of record, wood poles elsewhere on the lines under similar conditions have lasted considerably longer than this period, and some creosoted wood poles on another section of the system are in absolutely good condition after nine years of service, showing no deterioration whatsoever. Probably the poles on the 110,000-volt line will be about in a condition to stub at that time.

L. J. MOORE.

San Joaquin Light & Power Corporation,
Fresno, Cal.

A 100-Page Book That Provides Records of 2,000 Meters for Five Years

A METER-RECORD book of 100 pages takes care of 2,000 meters for four or five years by the system used in the Christopher (Ill.) office of the Central Illinois Public Service Company. In entering a meter in the book the last two figures in the number determine the page on which it is entered. For instance, No. 1061544 and No. 375844 are both entered on page 44. The meter number is entered at the left of the page, as the reproduction here shows, and immediately to the right on the same line are entered the "connect" and



SECTION FROM PAGE OF METER-RECORD BOOK

On this page, 44, are recorded the "connect" and "disconnect" data of all meters whose numbers end in 44.

"disconnect" data. This record consists of the "connect" or "disconnect" number and date, which are taken from the records which are kept separately when a service meter is changed. By referring to the "connect" number, which is numerically filed elsewhere, all details of the installation may be ascertained. In this meter book all "connect" data are recorded in black, while "disconnect" data are recorded in red. This system is much more practicable than entering the meters numerically. Each meter has a definite place in the book, and with a 15-in. x 18-in. (38-cm. x 48-cm.) 100-page loose-leaf book records of 2,000 meters may be kept without crowding for four or five years.

Christopher, Ill. JAMES F. MEISTER,
Local Manager.

Analysis of Hydro-Electric Plant Costs

THE following analysis of the segregated costs of the San Joaquin Light & Power Company plants in central California is of considerable interest in connection with estimates of the future growth of Western systems. The costs cover all hydro-electric and steam-plant installations in operation Jan. 1, 1918, and include dams, roads, miscellaneous structures and transmission equipment at the power house.

These costs are tabulated under four heads. The first gives costs per kva., calculated from the total rated kva.

POWER-HOUSE UNIT INSTALLATION COSTS

Accounts	Cost per Kva. of Total Generator Rating	Cost per Kw. of Greatest Peak Capacity of All Plants	Cost per Kw. of Hydro Capacity Available in August and September	Cost per Kw. of Hydro Capacity in August and September Plus Steam Capacity Available
Land	$1.84	$1.87	$3.30	$2.83
Storage reservoirs	20.69	21.05	37.14	25.71
Water conduits	28.58	29.09	51.32	35.53
Forebays	3.02	3.07	5.42	3.75
Penstocks	10.40	10.58	18.66	12.92
Buildings	6.97	7.09	12.51	8.56
Waterwheels	4.54	4.61	8.14	5.64
Boilers and equipment	6.62	6.74	11.88	8.23
Engines and turbines	7.23	7.35	12.97	8.98
Generators and exciters	4.67	4.75	8.39	5.81
Switchboards	1.60	1.63	2.88	1.99
Transformers	3.23	3.29	5.80	4.02
High-tension equipment	1.82	1.85	3.28	2.27
Miscellaneous structures	2.09	2.12	3.75	2.60
Miscellaneous construction costs	5.85	5.95	10.50	7.27
Totals	$109.15	$111.04	$195.94	$135.65
Capacity used	48,475 kva.	47,625 kw.	27,000 kw.	39,000 kw.

of all generators in the system; the second cost is per kw. of output when all plants are delivering their actual maximum output; the third column of costs is based on the greatest possible output by the hydro-electric generators during the dry months of August and September, and the last column is based on the combined outputs of the water and the steam turbines during August and September.

The figures given here, while they are of pre-war costs, are of value in that they represent the proportionate cost of the several major parts into which the total cost may be subdivided. G. R. KENNY.

Fresno, Cal.

More Than 123,000 Insulators Tested Alive at Cost of 2.13 Cents each

AT A COST of $2,624.58 total—about 2.13 cents each—123,069 insulators were tested during the year 1919 by the transmission department of the Georgia Railway & Power Company. In this testing, which was done by the "buzz stick," 13,196, or 10.7 per cent, were found defective. The annual report of the transmission department from which this information was obtained further states that 18,647 insulators were removed and 23,575 were installed on the 600 miles of line of this company. The increase in the number of insulators came about in changing about 100 miles to operate at 38,000 volts instead of 22,000 volts. Practically all of this insulator changing was done on live lines. Five hundred and one poles were reinforced. 105 were replaced and 219 were reset.

During the course of the year's operation it was necessary to open 158 transformers for inspection or

repairs, and twenty-two of them had to be taken out of service. Each line of the company was patrolled twelve times a year by three men, who walked 2,696 miles (4,330 km.) each in the year. The fourteen cars and trucks of the department traveled 151,790 miles (243,000 km.), averaging about 10,800 miles (17,400 km.) each, while two ¾-ton trucks made 14,646 and 14,582 miles (about 24,000 km.) respectively. The department handled very little new construction, only 1.7 miles (2.7 km.) of 66,000-volt line of No. 2/0 copper.

How Standardized Switchboards Aid in Substation Enlargements

ECONOMY of space, safety, accessibility for making changes and ability to make extensions quickly are features of a switchboard, like that shown in the accompanying illustration, used to control a 7,400-amp., 250-volt synchronous converter of the Kansas City (Mo.) Power & Light Company. The entire control of the converter itself is mounted on three panels (Fig. 1), the center panel, which holds the controlling instruments and auxiliary operating devices, separating the heavy main direct-current switches of opposite polarity which are on the outside boards. A panel to the right holds voltmeters for reading the pressure on sixteen feeder wires which connect to different points on the Edison system. By turning a rotary handle on the board the voltage in any of these feeders may be read. Mounted below this rotary switch on the rear of the board are the three fuses (positive, neutral and negative) of each circuit (Fig. 2).

Four 1,500,000-cm. (760-sq.mm.) outgoing cables are connected to each of the 16-in. (41-cm.) distribution panels with all positive switches in the upper row and negative switches in the lower. Each cable terminates (Fig. 3) in a copper link fuse covered by an insulating flash guard to prevent harm to an attendant replacing an adjacent fuse. In order that this box may be quickly removed to replace a fuse it is held on by a single cotter pin.

The switchboards are fastened to angle irons by bolts which can be removed from the front so that after these bolts are removed and the back connectors of the switches are unbolted from the feeders the entire panel may be removed from the front without interrupting service. There is sufficient working space for tightening nuts, and the framework is insulated from ground to prevent short circuit by a wrench handle swinging against the structural parts. Moreover, as buses of opposite polarity are widely separated, a short circuit between buses is not possible.

The feeder terminals and the buses are mounted on stone slabs and the whole structure is made as rigid as possible to prevent any movement of parts that would loosen the copper connections. Expansion joints are inserted in the long bus runs to allow for changes of length under temperature changes. The circuit breakers, oil switch and oil transformers are installed in the basement to avoid congesting the space near the board. The general features of this board have been in use for some time in St. Louis, and standard drawings and templates have been made so that any of the substation switchboards may be added to quickly and at a reasonable cost.

D. D. CLARKE,
Electrical Engineer.
Kansas City Power & Light Company,
St. Louis, Mo.

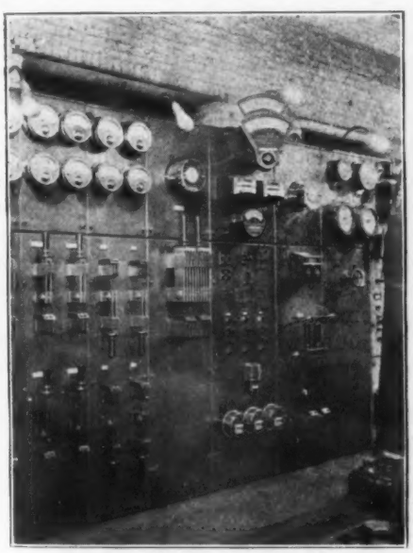


Fig. 1.

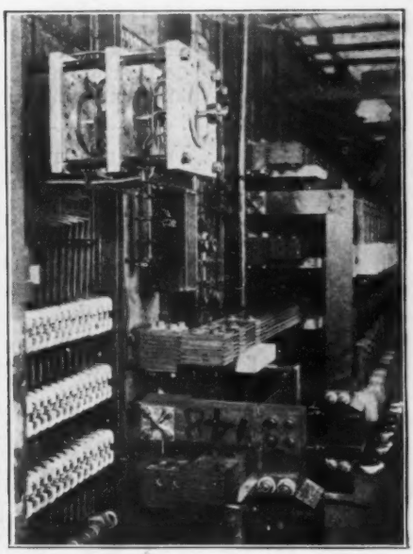


Fig. 2.

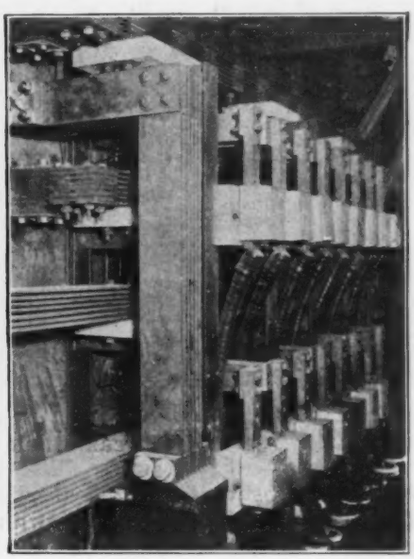


Fig. 3.

PANELS OF THIS BOARD MAY BE READILY REMOVED FROM THE FRONT.

Left—Control located on three panels, feeder panels to left and voltmeters reading at sixteen points to right. Center—Rotary voltmeter switch showing fuses for sixteen voltmeter leads. Right—Boxes inclose copper fuses for feeders; buses supported on stone slabs.

Separate Exciter Desirable for Each Steam-Driven Generator

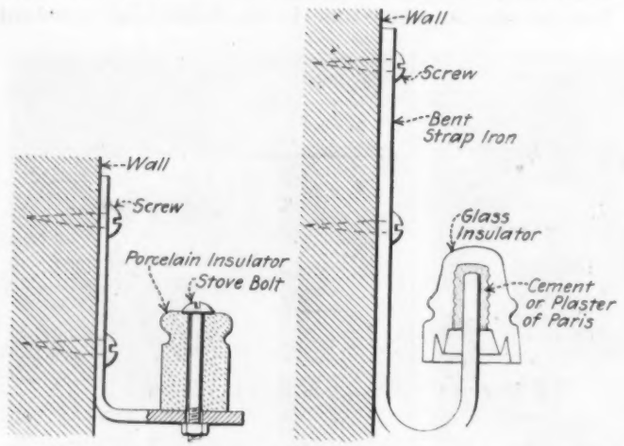
THE tendency in steam-station exciter practice is away from the common exciter bus and toward the practice of using a separate exciter on the shaft of each generator with an emergency unit so arranged that it can replace any direct-connected exciter in case of failure. The advantages of this arrangement are said to be those which accrue from segregation and simplicity in any electrical layout. These facts will be brought out at some length and instances of specific character will be discussed in the report of the electrical apparatus committee of the National Electric Light Association at Pasadena in May.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Insulator Brackets Easily Made from Bent Strap Iron

IMPROVISED insulator brackets for use where the standard manufactured types are not available can be made from a bent piece of strap iron. Two such brackets shown in the accompanying drawing have proved useful in telephone and lighting wiring. The telephone insulator is fastened on the bracket by means



TWO TYPES OF INSULATOR BRACKETS MADE OF BENT STRAP IRON

of a common stove bolt, while the lighting insulator is fastened on the U-shaped strap with Portland cement or plaster of paris. On account of the rapid setting qualities the plaster of paris is often the more convenient to use. Both kinds of supports should have holes drilled through them to accommodate screws or bolts.

C. E. CUNNINGHAM.

New Orleans, La.

Electrical Equipment Used in Ohio Rubber Plants

THE types and sizes of motors used for driving machinery making rubber goods in a number of Ohio plants are given in this article, together with their operating conditions. By far the largest share of electrical power in a rubber-working factory is used for driving the mill lines. A common rule to determine the size of motor required for mills is shown in Table I. Any rule, however, must be adapted to the many factors, such as the nature of the gum and compounds, temperatures, feeding of the rolls, etc., which affect the power required. The motor speeds are 600 to 720 r.p.m. line-shaft speeds, 75 to 100 r.p.m., and mill speeds, 20 to 25 r.p.m. Magnetic clutches as well as reversing switches are installed on all mill lines. The load on a mill line consists of cycles lasting twenty to thirty-five minutes, in which a maximum input is reached at the beginning of the cycle when cold gum and raw rubber are started. The load gradually decreases, showing lesser peaks as other ingredients are added or the sheets are folded. It will be noticed that the daily peak comes at 8 a.m. to 8:30 a.m.

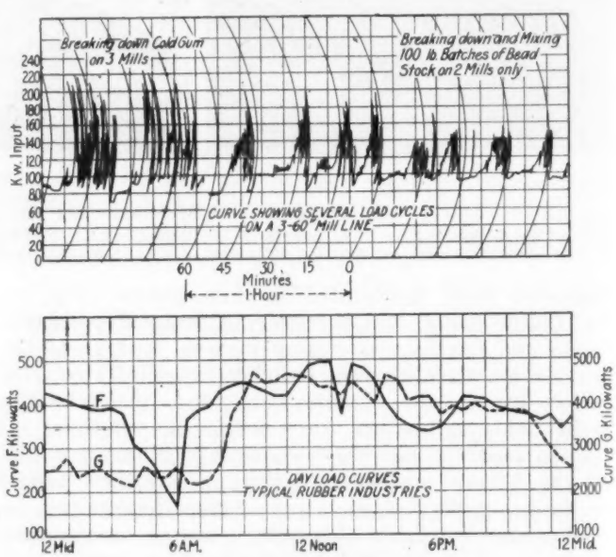
For calenders a shunt-wound interpole motor is employed to permit speed variation from about 225 to 900 r.p.m. and dynamic braking. To obtain a wide range of speed a three-wire 115/230-volt system is used. The size of motor, depending on the size of rolls, as shown in Table II, varies from 35 hp. to 250 hp. Rather elaborate control is necessary to obtain the wide speed variation required. By means of a rope accessible to the operator at the rolls the machine

TABLE I—APPROXIMATE SIZE PER INCH OF MILL OF MOTOR FOR RUBBER-MILL LINES

1½ kw. when one mill is connected per motor.
1¼ kw. when two mills are connected per motor.
1 kw. when three mills are connected per motor.
¾ kw. when more than three mills are connected per motor.
½ kw. as a minimum value.

TABLE II—SIZE OF MOTOR ORDINARILY USED WITH RUBBER CALENDERS

Size of Rolls (Diameter by Length)	Motor Hp.
18 in. x 54 in.	35
20 in. x 60 in.	50
22 in. x 60 in.	75
24 in. x 66 in.	90
32 in. x 90 in.	250



LOAD CURVES OF RUBBER PLANTS

Above, load cycles on a mill line driving three 60-in. mills. Below, daily load curve of a large and a small plant. The peak comes in the morning.

may be quickly stopped by dynamic braking. For conversion the rotary converter is employed with about 75 kw. for each 24-in. x 66-in. (62-cm. x 168-cm.) calender. For operating tubing machines the motors vary, as seen in Table III, from 15 hp. to 25 hp.

Power is usually sold to rubber plants at 3,800 volts or 22,000 volts, which is stepped down to 440 volts for the smaller plants and to 2,200 volts for the larger motors of the more pretentious plants.

TABLE III—SIZE OF MOTORS FOR RUBBER-TUBING MACHINES

	Hp.
Royle No. 3 perfected tubing machine	15
8-in. tubing machine	35
10-in. tubing machine	75
Royle No. 2 perfected tubing machine	25

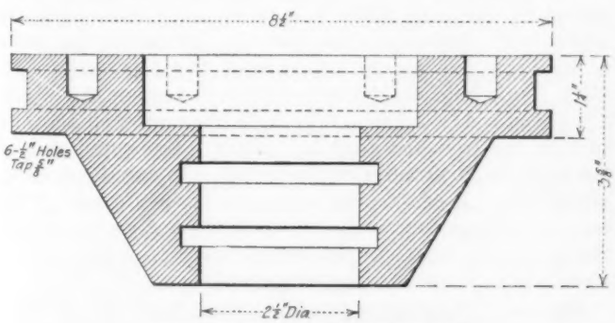
Stated briefly, a plant making 250 to 300 tires requires 375 hp. in motors, while one making 500 to 600 tires requires 750 hp. The demand factor ranges from 69 to 78 per cent. The yearly load factor averages between 20 per cent for a plant operating one shift and 35 to 40 per cent for three shifts.

To improve the low power factor, 60 to 65 per cent, which prevails on account of the general use of induction motors, synchronous apparatus should be more generally employed, especially for mill lines. One large manufacturer already has adopted synchronous motors with success. This type of motor has been developed to give 300 per cent of full-load torque and to operate at high efficiency, and it adds no complications to starting.

H. C. STEPHENS,
Power Engineer.
Northern Ohio Traction & Light Company,
Akron, Ohio.

Substituting Ball Bearings for Brass-Lined Ones Reduces Motor Repairs

OWING to trouble with the brass-lined bearings on motors of mine locomotives, the Quincy Mining Company (Mich.) found it necessary to replace these bearings with ball bearings. The trouble was due to the armature heating up at times of overload and melting the grease out of the bearings. With no grease in the bearing the shaft would cut the linings out and allow the armature to drop down on the pole pieces. To remedy the trouble it was decided to try ball bearings, so the bearing caps shown in the sketch were built to replace the old caps.



BEARING CAP FOR BALL BEARINGS

To prevent the ball race from turning on the shaft a jam nut is tightened against it on the pinion end of the shaft. On the commutator end a washer and cap screw perform the same function. The bearing shown in the sketch is for the pinion end, the one for the commutator end being slightly smaller.

Sixteen two-motor locomotives with sixty-four bearings were changed in this manner in 1916, and since that time no bearing troubles have been experienced.

J. C. KENDALL,
Electrician.
Quincy Mining Company,
Hancock, Mich.

How a Brass Bearing Was Used to Back Awkward Weld

IN WELDING a broken engine frame which could not be taken out of place for fear of misaligning the driver bearing, an old brass bearing lining was used by a Western shopman as a backing to give a curved shape to the weld. This lining was propped in position under the break and the hole was filled by electric welding. This brass piece, to which the welding material did not stick, was of the correct shape to give the proper curve to the weld.

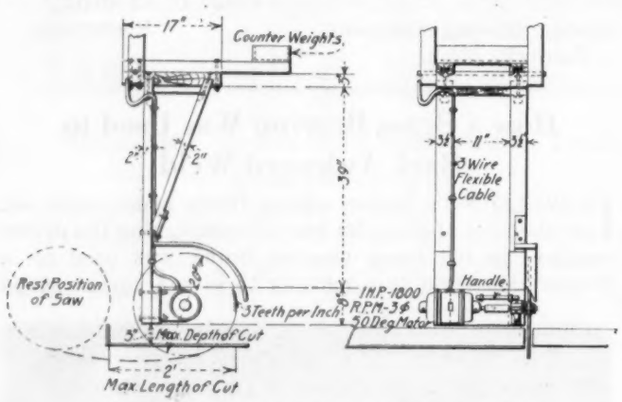
PROPER CURVE TO WELD PROVIDED BY BRASS BEARING LINING

F. A. ANDERSON.
San Francisco, Cal.

Direct Connection of Motor to Swing Saw Permits Use of Smaller Size

DIRECT connection of motors to the swing saws in a Massachusetts box factory has allowed the size of motor used to be reduced from 3 hp. or 5 hp. to 1 hp., with a consequent saving in first cost and in energy consumption. The motor and saw are both mounted on an oak frame as the illustration shows and are connected by a short shaft running in a bearing. The shaft is about 1 in. (2.5 cm.) larger than the motor shaft, which fits into it and is keyed to it. The other end of the shaft is turned down to fit the saw arbor. An iron rod passing through the upper end of the frame fits in holes in supports hung from the ceiling so that the saw can be swung for cutting. A counterweight fastened on the upper part of the frame makes the saw hang in the proper position. The 20-in. (51-cm.) saw shown is driven by a 1-hp., 1,800 r.p.m. motor, although a 3-hp. or 5-hp. motor was formerly used with the usual method of connection. This new construction eliminates the bearings at the top of the saw frame which supported

the frame and also drove the saw through a belt which was necessarily tight on account of being short and running in an almost horizontal position when cutting. Practically all of the power is transmitted to the saw, and when idling the wattless current is small compared with that of the larger motor. There is no power wasted



MOST ECONOMICAL DRIVE FOR SWING SAW

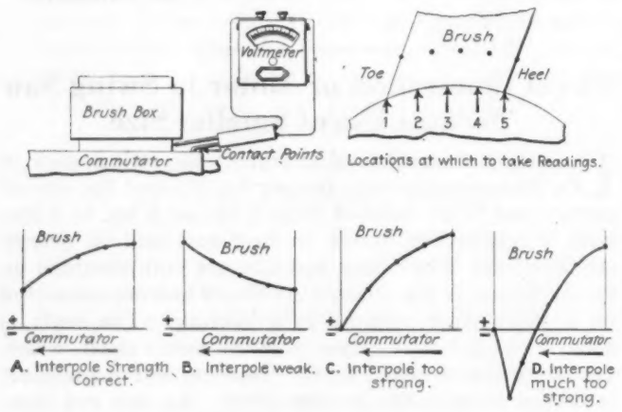
through a belt and the loaded bearings. Another advantage is that there is no belt to break and cause injury.

Such a saw is not desirable for very heavy cutting, but it has been used satisfactorily on $\frac{1}{8}$-in. (2.2-cm.) stock of various kinds of wood.

JOSEPH FRANZ,
Power Engineer.
Southern Berkshire Power & Electric Company,
Stockbridge, Mass.

Method for Testing Strength of Interpoles

SUITABLE contact points and a low-reading voltmeter may be used to determine the strength of interpoles of direct-current machines. A curve plotted from voltage readings taken at points on the side of the brush should droop in the direction of rotation (*A* in the drawing) but should not reach zero. If the curve rises in the direction of rotation, the interpole is weak, while if it drops as far as zero the interpole is too strong.



CURVES SHOWING STRENGTH OF INTERPOLES

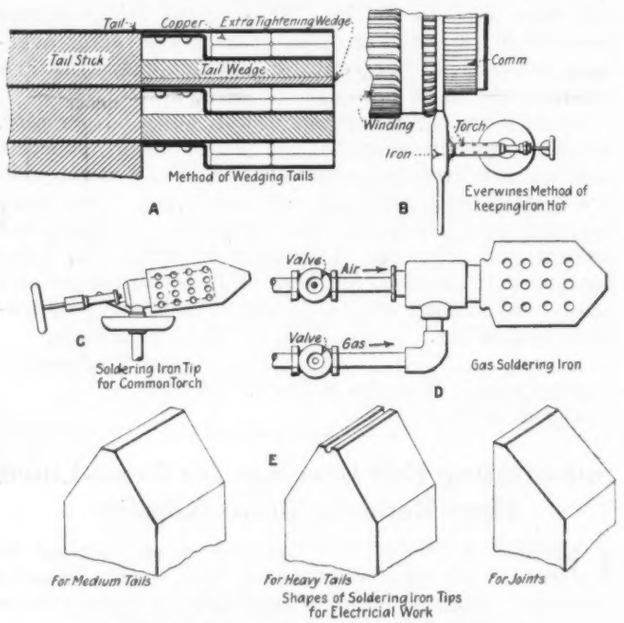
A—Correct strength; curve droops slightly in direction of rotation. B—Weak interpole; curve rises in direction of rotation. C—Too strong; voltage zero at toe of brush. D—Much too strong; voltage reverses about center of brush.

These contact points may be made of small wire taped to a wooden stick. Readings should be taken at the toe and the heel of the brush and at two or three points in between. If the interpole is weak, it should be brought closer to the armature by shimming, or maybe one or more turns of its winding are short-circuited and should be separated. If the interpole is too strong, it can be either moved further from the armature or part of the current may be shunted. This method cannot be depended on if it is not certain that the brushes are on the neutral point.

JAMES DIXON.
Cleveland, Ohio.

Tools and Methods for Correctly Soldering Commutator Tails

SOLDERING commutator tails must be well done, because a poor joint will cause trouble in the form of black spots on the commutator and hot joints. The difficulty of making a good joint at the commutator tail is due to the limited surface to which heat may be applied. Therefore care must be taken to clean the joints well,



IRONS FOR SOLDERING COMMUTATOR TAILS

and in order to bring the tails as close as possible to the leads wedges (*A* in the illustration) must be driven in between the tails. The soldering iron should be well tinned by rubbing while hot on sal-ammoniac crystals and solder. Sufficient time must be allowed for the joint to heat up thoroughly before applying the solder. A torch flame held on the iron (*B*) will hasten the work. This requires two men, one to hold the torch and another to hold the iron and feed the solder. For small tails a tip made to fit directly on the torch (*C*) may be used to advantage. A gas-heated iron (*D*) is very good. This iron has valves for regulating both air and gas to obtain the maximum heat. Some useful forms for the tips of irons for this work are shown at (*E*).

Success in soldering depends probably 90 per cent on having the joints clean and 10 per cent on good tools properly heated. For a flux the fluid recommended by the National Electric Code is composed of saturated solution of zinc chloride, five parts; alcohol, four parts, and glycerine, one part. Another good flux may be made of rosin dissolved in benzine. In a pinch rosin alone can be used or even good rosin varnish.

Boston, Mass. R. L. MCINTYRE.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Employees' Commissions on Appliance Sales

WITH the idea of bringing in new appliance business without disturbing other channels through which it would naturally come to the company, the Worcester (Mass.) Electric Light Company is now giving to its employees commissions on all the sales they make. Special sales slips are being issued for this purpose, one commission only being allowed on any one article. This is paid to the one who first presents the sales slip made out and signed in proper manner.

A commission of 10 per cent is allowed on electric flatirons and toasters and 5 per cent on all other articles except washers, mangles, ranges and similar appliances, for which $5 is paid, and vacuum cleaners, for which $1.50 is paid when the "prospect" makes the purchase. On old house wiring one-half of the commission allowed is paid to employees when the contract is closed, provided that the prospect has not already been called upon.

When it is necessary to make the sale on a time-payment basis as large a first payment as possible is obtained and the time of deferred payments made as short as possible. The following schedule of time payments is followed:

Retail Price	Cash Payment	Balance
$10 or less	$2	Three equal monthly payments
$10 to $30	$3	Six equal monthly payments
$30 and up	Time limit of twelve months except for washers	

Demonstrations are made according to arrangements made by the employee turning in the name of the prospect.

What Water Heating Means in Central-Station Revenue

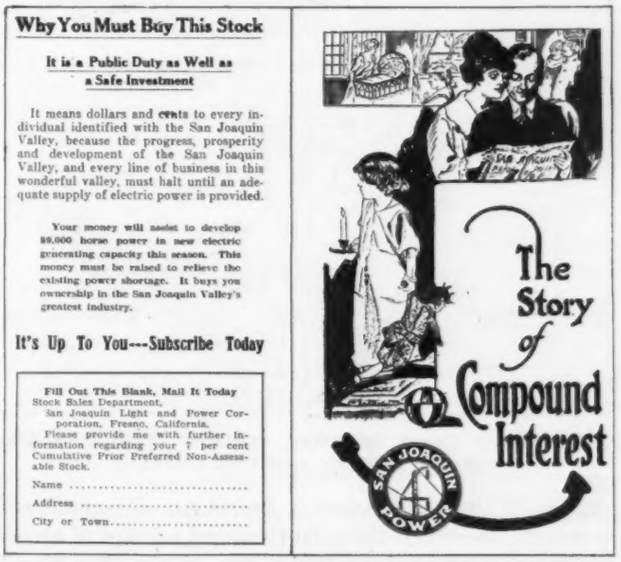
M. C. OSBORN, of Landers, Frary & Clark, New Britain, Conn., speaking of the domestic water heater as an indispensable adjunct to the electric range, before a group meeting of the New England Section of the National Electric Light Association, dwelt on the experience of Western hydro-electric companies in this connection. Flat rates have been made for the service with the water-heater feed cut in ahead of the range meter and with a double-throw, two-pole switch to cut out oven and broiler when the water heater is in operation, the heater being on one side of the three-wire circuit, the surface or broiling burners on the other side.

Thus the water heater demand does not show on the range peak at any time and does not necessitate increased expenditure for distribution and transforming meter. One kilowatt operating continuously will heat 75 gal. of water a day and consume 720 kw.-hr. a month. Assuming, however, that the average customer would use 30 gal. of hot water at 175 deg. F. a day, or 900 gal. a month, 360 kw.-hr. a month would be consumed, which at 1½ cents per kilowatt-hour would bring a revenue of $64.80 a year.

This Mr. Osborn believed to be a safe flat rate where there is thermostatic control, and although power conditions in the East are of course different from those in the Far West, where a large percentage of the available energy is unconsumed and could be marketed at a small additional operating cost, he contended that as a source of potential revenue domestic water heating compares most favorably with the manufacture of ice, street lighting and other business where there is no diversity factor.

Self-Interest Appeal That Gained New Stockholders

IN A PAMPHLET entitled "The Story of Compound Interest" the San Joaquin Light & Power Corporation, Fresno, Cal., has made effective use of a "self-interest" appeal in selling 7 per cent preferred stock to its customers, many of whom need additional power for irrigation of farm lands. Instead of basing a sales argument entirely upon the financial merits of the stock, customers are shown how their investment will furnish the company with new capital necessary for additional equipment, which in turn will make more power available for their requirements. The value of the stock as an investment is interestingly told in the following quotation from the pamphlet:


Why You Must Buy This Stock
It is a Public Duty as Well as a Safe Investment
It means dollars and cents to every individual identified with the San Joaquin Valley, because the progress, prosperity and development of the San Joaquin Valley, and every line of business in this wonderful valley, must halt until an adequate supply of electric power is provided.
Your money will assist to develop 89,000 horse power in new electric generating capacity this season. This money must be raised to relieve the existing power shortage. It buys you ownership in the San Joaquin Valley's greatest industry.
It's Up To You---Subscribe Today
Fill Out This Blank, Mail It Today
Stock Sales Department,
San Joaquin Light and Power Corporation, Fresno, California.
Please provide me with further information regarding your 7 per cent Cumulative Prior Preferred Non-Assessable Stock.
Name .....
Address .....
City or Town.....
The Story of Compound Interest
SAN JOAQUIN POWER

FRONT AND BACK OF "SELF-INTEREST" APPEAL ISSUED BY CALIFORNIA POWER COMPANY

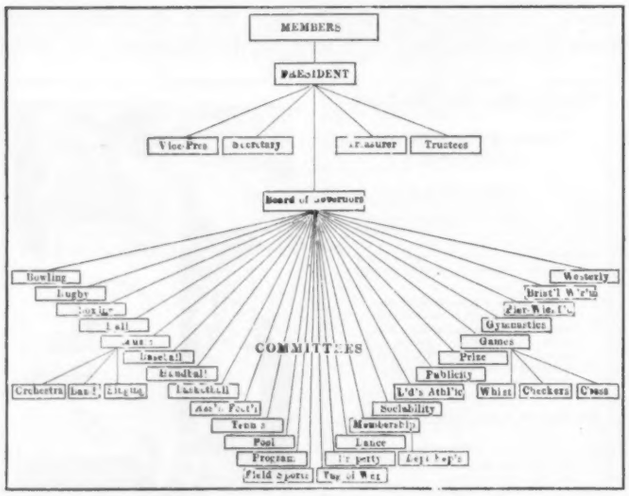
"This stock makes an ideal 'nest egg' for your children. It will teach them the story of interest—how to save and practice thrift. The quarterly dividends,

if deposited every ninety days in a savings account to accumulate and draw interest compounded regularly at 4 per cent, will equal the par value of the stock in eleven years and six months. Therefore, if you buy your child ten shares of stock for $985 now, eleven years and six months from now your child will have $1,013.07 on deposit in a savings bank account and $1,000 in San Joaquin Light & Power Corporation prior preferred stock, which undoubtedly will have increased beyond par value by that time. Your money will serve a twofold purpose. It will help to develop the San Joaquin Valley, to the benefit of every land owner, carpenter, banker, newspaper man and every person interested in every line of business activity. Second, it will provide a bank account and a sound investment for the future welfare of your children."

During the first month $500,000 of this preferred stock was sold. The average amount taken by each purchaser was ten shares, making 500 new customer-stockholders in the company.

Good Fellowship Club of the Narragansett Company

LAST November the Narragansett Electric Lighting Company of Providence, R. I., organized what is known as the Nelco Athletic Club, whose object it is to promote good fellowship among employees in the Narragansett company and its associates, which include the Westerly Light & Power Company, Mystic Power Company, Narragansett Pier Electric Light & Power Company and Wickford Light & Power Company. The



ORGANIZATION CHART OF NELCO ATHLETIC CLUB OF NARRAGANSETT ELECTRIC LIGHTING COMPANY

officers of the club include a president, vice-president, treasurer, secretary, three trustees and a board of eleven governors. All of these hold office for one year except the trustees, who are elected for terms of one, two and three years. Franklin L. Hall, secretary and treasurer of the Narragansett company, who was elected president of the club, has the following to say concerning its formation and work:

I do not know of anything the company has ever done which has brought the employees of the various departments into such close touch with one another or has been of such benefit to the company as has the forming of this athletic club. The idea is, instead of having a few persons looking after everything in connection with the club's affairs, to have as many employees as possible each having a little to do. By this means the individual interest is kept at a high point at all times, and any employee of the company who has any red blood in him at all can find something among the various activities to take part in personally.

Each one of the committees is composed of at least three persons. In the case of both the sociability and the membership committee there are twelve members. No one committee has two persons from the same department serving on it. In other words, the personnel of the committees is drawn from different departments as far as possible.

Tournaments in the various athletic activities are arranged during different seasons. For instance, we have had a bowling tournament running all winter, in which fully seventy-five members took part each week. Other tournaments, such as boxing, handball, basketball, pool, tug-of-war, whist, checkers, chess, etc., have been carried on during the winter months inside. Baseball, tennis, field sports, swimming, etc., will be taken up during the summer months.

Although the number of employees making up the committees and taking part in all of these activities might seem to be cumbersome to handle, it has, on the contrary, proved to be the easiest thing imaginable. As will be noted from the accompanying diagram of organization, all of these committees are responsible to a board of governors of eleven members. This board of governors holds regular monthly meetings in the directors' room of the company, at which the president of the club is present as chairman of the board.

A special committee has been appointed to cover the athletic and social work in our subsidiary companies in different parts of the state. In the chart of organization these committees are headed Westerly, Bristol and Warren, Narragansett Pier, and Wickford, showing where these subsidiaries are located.

Other forms of welfare work carried on by the company include a group plan of life insurance, an installment plan for selling stock to employees, co-operative purchase of coal, and publication of an employee magazine of personal and educational value.

Advertising Appropriations for Central Stations

L. D. GIBBS, superintendent of advertising of the Edison Electric Illuminating Company of Boston, advocated consistent advertising year by year in a discussion at the recent question-box conference of the New England Section of the National Electric Light Association. He pointed out that if 5 per cent of the gross revenue can be used in this way the outlay will be ample, and that in most localities like the thickly settled districts of New England 2 per cent of the gross of the central station's business is sufficient. It is advisable to devote half this appropriation to so-called "good will" or "courtesy" advertising and the rest to merchandising.

"Our business," said Mr. Gibbs, "is too much like the way the average man works. The average man, if he would set himself a good average pace and stick to that pace every day, would accomplish much more than he even imagines now to be possible simply by keeping steadily at it. If the average sales person who goes out to sell or who is behind a counter would set himself or herself some sort of standard to sell up to and go straight on throughout the year, developing all the supporting lines through extending acquaintanceship and adding to the little services and attentions given to customers, this bogie or average would then become possible. It is the same with advertising. We are too much inclined when we have a little money in sight to use it all up before the sales organization really gets going;

after it gets going there is often nothing left with which to back it up and so a lag and loss of efficiency result.

"In our own minds, in the Boston Edison Company, we feel that we do very little display advertising in the newspapers compared with the size of our business and the territory we cover. I was talking not long ago with Mr. Richards, advertising manager for Jordan-Marsh. I asked him about the percentage of their gross that they allow for display advertising and about some of the different angles of their policies. He said: 'I should think that, in your electrical business, if a store on its own account, or a man running an appliance store by itself, or a central station, spent 5 per cent of its last year's gross on this year's advertising, this would be doing very well and would get wonderful results.

"You will be interested to know that it has been figured very carefully that if you spend $5,000 this year for advertising you will have $4,000 worth of that advertising coming to you next year, and $3,000 the next, $2,000 the next and $1,000 the next. Thus the $5,000 that you spend this year will have pulling power in diminishing ratio through five years, but it won't have that pulling power unless you add to it and keep it alive. So, if you put in $5,000 this year for advertising and $5,000 next year, you will really get $9,000 worth of advertising next year. You put in $5,000 in the third year and you have $12,000 worth of advertising; that is, you secure this effect in your third year if you keep your work going right along. That runs to a certain period and begins to build up again. Therefore a man beginning in business should use from 7 to 10 per cent of his gross in advertising. If part of his business is with nationally advertised commodities, he can reduce that 7 to 10 per cent to 5 or 7 per cent in the beginning of his business. When he gets well established he can do very well with from 2 to 5 per cent of his gross, and if he is handling national products he can easily go down to from 1 to 3 per cent of his gross."

W. F. Abely, Western Electric Company, Boston, said that, speaking nationally for the electrical contractors, a study made in the past year showed that for a progressive electrical contractor-dealer the first year the average appropriation would be about 8 per cent of the gross sales, for the second and third years 5 per cent, and for the fourth and fifth years 3 per cent. This estimate checks closely with Mr. Gibbs' figures.

Governor of Indiana Condemns Municipal Ownership

MUNICIPAL ownership and operation of utilities is condemned by Gov. James P. Goodrich of Indiana in a note published by *Flash*, the house organ of the Merchants' Heat & Light Company, Indianapolis. Declaring that "no business can thrive on politics and inefficiency," the Governor points to the poor showing of a typical municipal plant investigated by the Public Service Commission of the state. In this plant it was disclosed that fifteen of its thirty-two power consumers were paying less than the cost of generating the energy consumed, no allowance being made for the return on the investment. There was an inefficient combustion of coal at the plant, 7.92 lb. of coal being required to generate one kilowatt-hour, whereas efficiently managed private plants find 3 lb. or 4 lb. sufficient. The plant was poorly located, there was lack of centralization and of fixed responsibility in the management, a large overload existed but no reserve equipment, general incompetency marked its operation.

"Speculative features of public utility ownership and operation," the Governor concludes, "have been practically eliminated by regulation, so that under equal conditions the privately owned utility should be and is able to furnish the same service at lower rates than the publicly owned utility if the publicly owned utility is charged with interest on its investment and proper depreciation charges."

Central Station Merchandising Costs

THE Utah Power & Light Company has a system of analyzing its merchandising accounts which makes it possible to see from month to month just what portion of every dollar expended goes toward the various elements of overhead and other expenses. Such an analysis for two succesive months is given here:

INCOME AND EXPENSE STATEMENT
MERCHANDISE DEPARTMENT

Division Date ending 1918

	FOR MONTH		CUMULATIVE TO DATE	
	This year	Last year %	This year	Last year %
Revenue from Merchandise Sales				
Cost of merchandise				
Cost of merchandise				
Storeroom salaries and expenses				
Defective merchandise replaced				
Total cost of goods sold				
Cost of installation				
Total cost of goods and installation				
Gross profit				
Selling expense				
Merchandise salesmen's sal. and com.				
Rental of stores				
Total selling expense				
Net profit				
General expense				
App. div. accounting expense				
App. general sales dept. expense ($ per month)				
Advertising and demonstrations				
Miscellaneous expenses				
Ins. and taxes (¼ of 1% of total stock)				
Uncollectible accts. (¼ of 1% of total sales)				
Total general expense				
Net earnings				
Fixed charges				
Interest on investment (½ of 1% per month based on $ invest)				
Interest on working capital (½ of 1% per month based on $ def. acct.)				
Depreciation and interest (10%) on store fixt. used for merchandising				
Total fixed charges				
Net income or loss				
Percent net income				
REMARKS:				

	Cents
Cost of goods sold	72.66
Merchandise, salesmen's salaries, etc.	3.92
Cost of installation	2.93
Rental of stores	1.26
General expense:	
Accounting expense	1.50
General sales department expense	0.95
Advertising and demonstration	2.69
Miscellaneous expense	1.59
Insurance and taxes	0.95
Uncollectible accounts	0.25
Fixed Charges:	
Interest on investment	2.89
Interest on working capital	0.78
Depreciation and interest on fixtures	0.01
Net income	7.62

The total sales for the two months amounted to $84,467.72.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Locating Faults in Induction Motors.—A. M. DUDLEY.—This is the first of a series of three articles and deals in particular with problems indicated by noise and vibration. It is shown how to distinguish between mechanical and electrical troubles and it is pointed out that certain observations should be made of the behavior of a motor when started for the first time.—*Power*, Feb. 24, 1920.

Sine Wave-Testing Sets.—E. J. BURNHAM.—The author points out that there are many uses in the laboratories of colleges and research and testing departments for a sine wave generator, and it is to meet the demand that the sets described have been developed. Oscillograms and test data show that the generator maintains practically a true sine wave of voltage from no load to full-load unity power factor and full-load zero power factor. The generator is specially useful for testing the magnetic properties of iron and for meter testing.—*General Electric Review*, February, 1920.

Ventilation of Steam Turbine-Generators.—GEORGE MONSON.—This is a review of the development of forced air ventilation for cooling large generators. On the early machines salient poles were used which served to draw in the air and expel it through the ducts in the stator laminations. The next step was to provide passages through which air from the outside of the building could be obtained. The accumulation of dirt in the windings led to the introduction of air washers, which while removing the dirt at the same time reduced the temperature of the air. As the size of generators increased fans were introduced to increase a circulation of air. Separate blowers were used in some cases, but later designs embody the ventilating fans as part of the rotor structure. The latest system employs the closed air circuit and conserves space by mounting the humifying equipment and air driers under the generator foundation. The advantages are the elimination of numerous station ventilating ducts and quantities of dirt that are decrease in eye trouble among miners.—London *Electricity*, March 12, 1920.

Lamps and Lighting

Lighting Conditions in Mines.—An investigation of lighting conditions in mines was undertaken with special reference to protection of the eyesight of miners. It is estimated that up to the year 1914 the average illumination on the coal face in pits where safety lamps had to be used was about 0.018 ft.-candle, whereas in "safe" mines where candles can be used the average illumination was 0.09 ft.-candle. It is said that the introduction of the improved forms of electric lamps has led to a decrease in eye trouble among miners.—London *Electricity*, March 12, 1920.

Generation, Transmission and Distribution

Protective Apparatus for Alternating-Current Systems.—M. ROSEBOURNE.—The protective relays which serve to disconnect faulty elements in a distribution system by tripping the oil circuit breakers may either operate when the current passes a certain maximum value or they may be so connected as to operate when the currents become badly unbalanced. With the latter system the relays are fed from special differential transformers. As soon as a case of unbalance occurs and exceeds a certain limit the relays operate. To protective devices working on this principle a high degree of selectivity can be given, so that only the faulty member will be disconnected and the disturbance will be limited to a small part of the system. In adapting the principle of unbalance, for instance, to the protection of a transformer, relay transformers are inserted in each phase, one on the primary and one on the secondary side. By choosing the proper number of turns and connecting the secondaries of the two transformers in opposition a balance will obtain when supply currents and load currents have the proper relation. If a fault occurs in the transformer, the entering current will be abnormally large and the relays will trip out the breakers. Similar devices may be used to disconnect a faulty transmission line. For this purpose each line conductor is split into two parallel parts, which are both carried through the relay transformers so as to give a balance if the current divides evenly. If one conductor breaks off or is earthed, the balance is disturbed and the line is disconnected.—*Revue Générale d'Electricité*, Nov. 29, 1919.

Traction

Butt-Welded Joints Installed on the Lines of the Pittsburgh Street Railways.—Molds are placed around the rail joints to hold the heated flux while clamps force the rail ends together. The equipment used and the methods of making the weld are shown with illustrations in this article.—*Electric Railway Journal*, Feb. 21, 1920.

Automatic Railway Substations.—FRANK W. PETERS.—This paper reviews the broad range of conditions to which railway automatic substations have been applied and also discusses the economies and operating advantages effected by their use. A description is given of the modern equipment with details of its operation. Special reference is made to improvements in design of control apparatus, to the positive sequence of starting the machines and the protection afforded the apparatus against overloads or other irregularities either outside or internal to the stations.—*Journal A. I. E. E.*, March, 1920.

Installations, Systems and Appliances

Electricity in Gold and Silver Mining.—B. B. BECKETT.—This paper covers both the mining proper and the milling, since gold and silver ores are usually milled at the mines as part of the same enterprise. Of the two operations, mining and milling, the latter is the heavy power consumer, taking about three-fourths of the total. Milling also is the more desirable load from

the central-station point of view, since it is steady and continuous twenty-four hours a day and every day of the month. The load factor of a mill load is about 80 per cent and that of a combined mine and mill load about 70 per cent. Power consumption for all purposes will be close to 40 kw.-hr. per ton of dry ore mined and milled, of which 30 kw.-hr. will be consumed by milling alone. An interesting table is given to show the actual power consumed in a typical property in Goldfield, Nev., for operation during the years 1915, 1916 and 1917.

POWER CONSUMPTION AT GOLDFIELD

Mines:	Motor Capacity, Hp.	Maximum Load, Hp.	All-Day Average, Hp.	Kw.-hr. per ton Dry Ore
Light equivalent	....	15	10	.2
Compressed air	400	420	260	5.3
Pumps	280	210	93	2.0
Hoists	750	1,000	88	1.8
Miscellaneous power	100	30	7	.2
Total mines	1,530	....	458	9.5
Mill:				
Crusher (gyratory)	150	50	10	.26
Conveyors to battery	60	40	12	.29
Stamp battery	250	240	212	4.26
Tube mills	400	480	448	9.20
Chilean mills	200	300	190	3.86
Concentrate tables	60	34	31	.63
Air compressors (for agitation chiefly)	250	250	240	4.9
Pumps	340	215	156	3.3
Miscellaneous power	270	100	50	1.2
Light and heat	....	80	40	.8
Total mill	1,980	....	1,389	28.70
General departments, light, heat, and power				1.4
Losses in line and transformers and in regulation				3.4
Total all				43.0

The production of this mine is 1,000 tons of dry ore per day. Mining is carried on through vertical shafts with an average depth of 600 ft. (180 m.), with a moderate amount of water to be pumped, and the mill was the usual stamp mill with cyanide treatment. The author analyzes the various processes in order to get at the power requirements.—*Journal of Electricity*, March 15, 1920.

How Electricity Helps Solve the Package Freight-Handling Problem.—F. T. SMITH.—It is said that freight is handled today at a great many of our seaport terminals by methods used several hundred years ago. The author shows that cranes, trucks and tractors may be used to advantage in loading and unloading operations at piers and railway terminals. The advantages to be expected from the adoption of electrical machinery are given as (1) decreased cost of handling per ton; (2) increased terminal capacity; (3) increased storage capacity; (4) increased handling capacity in the terminals; (5) decrease in the length of time in handling, and (6) increased prestige of the port terminal as the outcome of these results.—*Marine Engineering*, January, 1920.

Electrochemistry and Batteries

Theoretical Study of Nitrogen Fixation by the Electric Arc.—CHARLES P. STEINMETZ.—The second installment of the series dealing with the chemical dynamics of the nitrogen-oxygen reactions at the temperature of the arc and during cooling. In this installment the author gives the effect of the rate of cooling upon the dissociation of NO.—*Chemical and Metallurgical Engineering*, Feb. 24, 1920.

Melting-Point Methods at High Temperatures.—LEO I. DANA and PAUL D. FOOTE.—A description of the determination of melting points of metals, alloys, salts and refractory materials by the use of thermo-electric resistance and optical pyrometers.—*Chemical and Metallurgical Engineering*, Jan. 7 and 14, 1920.

Comparison of Existing Methods of Measuring the Temperature of Molten Steel.—F. W. BROOKE.—The author briefly describes the use of thermocouples and radiation and optical pyrometers in measuring the temperature of molten steel. He also explains how the film, rod and pouring tests are employed for the same purpose.—Paper presented at American Foundrymen's Association, Philadelphia, Oct. 2, 1919.

Units, Measurements and Instruments

A New Interferential Dilatometer.—IRWIN G. PRIEST.—Description of a dilatometer for measuring small differential thermal or other changes in length by means of the change in width of interference fringes.—*Scientific Paper No. 365, U. S. Bureau of Standards*, Feb. 28, 1920.

Telegraphy, Telephony and Signals

Line Fed by Undamped Oscillations.—L. LOMBARDI.—In a former article the author studied the behavior of an artificial line under the action of damped oscillations. In the present contribution the results of experiments made upon the same artificial line fed by undamped oscillations are published. The theory of the propagation of sinusoidal undamped waves in conductors in which resistance, inductance and capacity are uniformly distributed is given, and the corrections to be made to the results of this theory when the inductance and the capacity are not uniformly distributed are also stated. The experiments were made with the line open, short-circuited or closed through an ohmic resistance equal to the characteristic resistance of the line; with direct or indirect excitation by a Poulsen arc, and with the fundamental odd and even harmonics. The results of the experiments for the fundamental frequency and odd harmonics agree substantially with those given by the Kennelly theory, but for the even harmonics they are sensibly different, and precisely, the apparent impedance is found to be considerably smaller than that given by theory, such divergence being due to the presence of higher harmonics in the emf. furnished by the Poulsen arc.—*Science Abstracts, Section B*, Dec. 30, 1919. (Abstracted from *Elettrotecnica*, Sept. 15, 1919.)

Electric Signaling.—WOLF.—Electric signaling devices are rapidly displacing the old mechanical systems used for transmitting, for instance maneuvre orders to the engineer on a steamer. A great number of different systems for this type of electric signaling are described in the article. Methods for automatic blocking of the signal until a correct repetition of the order is given from the receiving end are also taken up. Modern signaling systems for steamers are often provided with electrically operated automatic recording devices for registering simultaneously the given order and the day, hour and minute when it was given.—*Elektrotechnische Rundschau*, Sept. 15, Oct. 1 and 15, 1919.

Long-Distance Radio Communication in Chile.—E. W. FIELDING.—The Chilean radio stations at Llanquihue and Punta Arenas are described in detail. The best wave length and power for this 875-mile (1,349-km.) transmission are given. The effects of strays, their reduction and signal fading are discussed.—*Proceedings Institute of Radio Engineers*, February, 1920.

News in Brief

SUMMARY

of Important Happenings in the Industry During the Week

DEMAND for building material, which has been slightly lower during the railroad tie-up, is now rapidly increasing on account of renewed activities in Boston, New York and Chicago. The outlook is better than it has been for many weeks. Perishable freight is now being moved on virtually all railroads, thus guaranteeing the delivery soon of much building material, including conduit, wire and porcelain, held up by the blockade.

LAMP CORD, loom and heating appliances have been unloaded from freight cars found by jobbers in the yards. In addition, stocks of porcelain material, fuses, heating appliances; line material and other miscellaneous supplies have been received by parcel post and motor trucks. These have been the only available methods of shipment, and many jobbers and manufacturers have used them.

GENERAL price changes are few. Increased delivery charges for trucking and parcel post will probably be met by the consumer. These charges are found to be about 15 per cent above former delivery charges.

WIRE mills are well up to capacity on rubber-covered wire orders and are able to ship quickly or at leisure as the necessity of the case warrants. Bookings are at a rate more than double last year's record volume. The proportion of orders of No. 14 to orders of other sizes of N. E. C. wire has been diminishing since the first of the year, giving rise to the belief that more larger size code is being ordered. Brass mills are working to capacity, where strikes and shortage of raw materials do not hinder, and are getting behind on orders for copper and brass rods, tubes and sheets. Insufficient labor precludes resorting to night shifts, necessary to supply the demand, although some mills are working well into the evening several nights a week.

A SUB-COMMITTEE of the British Board of Trade Committee on Trusts has reported that the Electric Lamp Manufacturers' Association is a combination of three large companies, one under American control, and that it has limited output and may, if not checked, lead to American control of the British lamp industry. English electrical and engineering papers characterize the report as ill advised.

A CONTRACT for the electrification of 28 miles of double-track railroad between Jundiahy and Campinas, Brazil, has been awarded to the International General Electric Company.

THERE was a chance that the Congressional water-power conferees would get together on Tuesday, but at the last minute the meeting was postponed.

IN THE legislative, executive and judicial appropriation bill, which has just been disposed of finally by Congress, the sum of $60,000 is made available for enforcing the wireless communication laws.

An appropriation of $30,000 was made for the investigation and standarization of methods and instruments employed in radio communication. The work in that connection is to be done by the Bureau of Standards.

ENTERTAINMENT features of the Pasadena convention of the N. E. L. A. will include visits to Santa Catalina Island, Avalon, "Filmland" and the "Orange Empire."

MINNESOTA, South Dakota and North Dakota have been formed into the North Central Geographic Division of the N. E. L. A., the existing electrical associations of the two states first named being merged in the new body. T. D. Crocker of Minneapolis was elected president.

A QUESTIONNAIRE addressed to the members of the American Society of Civil Engineers shows the defeat by that body of the proposal to create a comprehensive organization to insure the united action of the engineering and allied technical professions in matters of common interest.

THE FIRST meeting of the Conference Club under the new plan which makes its membership representative of the entire electrical industry will be held at White Sulphur Springs, W. Va., on June 17, 18 and 19.

A RESOLUTION has been adopted in the New York State Legislature indorsing the federal water-power bill now in conference at Washington and urging that its passage be expedited.

PUBLIC utilities, in the opinion of J. G. White, have "passed the peak of the crisis" and would not be so seriously affected as other lines of industry by a period of liquidation and readjustment.

A CHARTER for a foreign banking association, the first issued under the Edge bill, a measure designed to enable American manufacturers to compete in foreign markets on a credit basis, has been granted to the First Federal Foreign Banking Association of New York, capitalized at $2,100,000.

FINAL approval to the proposed changes in the constitution of the National Electric Light Association has been given by the executive committee. An engineering department is to be established with W. J. Canada, as engineering expert. The name of the Technical and Hydro-Electric Section of the association will be changed to Technical Section.

THEODORE N. VAIL, chairman of the board of directors of the American Telephone & Telegraph Company and the man to whom the vast development of the American telephone is mainly due, died at Baltimore on April 16 in his seventy-fifth year.

FIGURES issued by the Federal Trade Commission for January, 1920, show that the cost of bituminous coal at the mine in that month averaged $2.34 for the whole country, as compared with $2.11, the monthly average for the whole year 1918.

PLANS for increasing generating facilities and bringing about operating economies in plants of the Cities Service Company situated at Toledo, Ohio; Amarillo, Tex.; Bartlesville, Okla.; Cheyenne, Wyo.; Durham, N. C.; St. Joseph, Mo., and other places are going forward.

INTERCONNECTING lines are now being constructed between the Pennsylvania-New Jersey system of the General Gas & Electric Company and other systems which will give to the combined companies a capacity of nearly 250,000 kw.

GROUNDING the neutral was the topic discussed at the Pittsburgh Section meeting of the Association of Iron and Steel Electrical Engineers, and the practice was generally favored for large power systems.

SIX TECHNICAL sessions will be held by the A. I. E. E. at its White Sulphur Springs (W. Va.) convention, June 29 to July 2, when committee reports will be made, symposiums held and many papers presented.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Elaborate Entertainment Program for the Pasadena N. E. L. A. Convention

ALTHOUGH the Pasadena convention of the National Electric Light Association, May 18 to 22, will be an extremely busy one, the entertainment features are not being overlooked. "Hillside," the beautiful home of John B. Miller, president of the Southern California Edison Company, and the wonderful grounds surrounding it will be the center of the chief social events for the ladies who attend the convention.

To make it possible for delgates who visit the convention to see every feature of southern California life within the shortest space of time, with the greatest possible convenience, and by special arrangements such as are not obtainable by the individual tourist, is the aim of the chairman of the entertainment committee, W. L. Frost. Among the points to be visited are Santa Catalina Island, Avalon, "Filmland," some of whose sixty motion-picture studios, ordinarily closed to the public, may be visited by delegates, and choice parts of the "Orange Empire." A trip has been planned to San Diego, which lies close to the Mexican border and is famed for its beautiful harbor and ocean scenery. Arrangements are now under way for an airplane "taxi" service, and it is hoped that a landing field can be established near the Hotel Huntington.

Those who desire to visit the great hydro-electric properties of the power companies of the Southwest will be provided with automobiles and guides for excursions into the mountains.

Cities Service Going Forward with Plans for Increased Capacity

PLANS to increase generating facilities and to bring about operating economies in the electric light and power subsidiaries of the Cities Service Company are going forward. The majority of the properties are unable to meet the demands being made upon them for power.

A second 20,000-kw. generating unit is being placed in commission at the Acme Power Company, in Toledo, Ohio, and installations have been made permitting the burning of coke oven gas under the boilers. The City Light & Power Company of Amarillo, Tex., will shortly start to use natural gas as fuel. The Bartlesville (Okla.) Gas & Electric Company is installing 1,000-kw. additional generating capacity, and the Athens (Ga.) Railway & Electric Company is putting in additional boiler capacity. The 1,000 kw. of generating capacity for the Western Light & Power Company at the Cheyenne (Wyo.) plant will soon be installed, and during this summer another boiler with spray-pond equipment will be added to the plant. The Durham (N. C.) Traction Company is making improvements in its generating station, and the United Water, Gas & Electric Company at Hutchison, Kan., will install 1,000 hp. additional boiler equipment. Improvements, including boiler equipment, are also being made to the plant of the Lincoln (Neb.) Gas & Electric Light Company. The Meriden (Kan.) Light & Railway Company has been converted into a fuel-oil-burning plant, and the new 10,000-kw. generating unit at the plant of the St. Joseph (Mo.) Railway, Light, Heat & Power Company was placed in regular service April 1.

American Equipment for the First South American Main-Line Electrification

THE first main-line railroad electrification in South America will be on the double-track line of the Paulista Railway Company between Jundiahy and Campinas, Brazil, a distance of 45 km. or about 28 miles.

A contract for nearly $2,000,000 in equipment for the electrification, it was announced this week, has been awarded to the International General Electric Company. This equipment consists of twelve locomotives—eight freight and four passenger engines—material for the transmission system and substation and for a 3,000-volt overhead line. It is one of the largest railway contracts awarded since the Chicago, Milwaukee & St. Paul electrification. This project anticipates further extensions amounting to 100 additional miles of route, which may eventually bring the total electrification up to 128 miles (205 km.), extending between Jundiahy and San Carlos. Power for the operation of the lines will be supplied by the Sao Paulo Light & Power Company at 88,000 volts, 60 cycles. The locomotives will be of the geared type, 3,000-volts direct current, and equipped with regenerative braking apparatus. The freight locomotives will weigh 100 tons each, and the passenger engine 120 tons. It is expected that the new line will be in operation in July, 1921.

Conference Club Meeting Planned for June 17-19

PLANS for the first Conference Club meeting with its new membership representative of the entire electrical industry are now being laid. It has been decided to hold the meeting at White Sulphur Springs, W. Va., June 17, 18 and 19.

Invitations went out a little over two weeks ago to twenty-one proposed members. At the time of going to press ten of these had accepted and other acceptances were expected in the course of a few days. The committee on constitution and by-laws, to which will be delegated the most important work connected with getting the Conference Club under way according to its new program, will probably be appointed some time during the coming week. The June meeting will be largely devoted to the report of this committee.

Death of Theodore N. Vail

THEODORE NEWTON VAIL, chairman of the board of directors of the American Telephone & Telegraph Company, died at Johns Hopkins Hospital in Baltimore on April 16 of a complication of cardiac and kidney troubles. Mr. Vail was in his seventy-fifth year at the time of his death.

For many years at the head of the most extensive privately owned public utility in the world, Mr. Vail built up a great reputation through his ability for organization, his indomitable courage and his adherence to the fundamental principle of the best service possible for the public. It was Alexander Graham Bell whose inventive genius brought forth the telephone. It was Theodore N. Vail, with the blood of pioneers in the realm of engineering development strong in his veins, whose clear vision made possible the perfection in the realm of telephony known today. As an organizer Mr. Vail knew no superior. He is sometimes spoken of as the organizer of the fast mail-train service. Certain it is that to him belongs the credit for building the Bell telephone system. When the system needed a strong man at the helm during the stormy period of the 1907 panic, the directors instinctively turned to Mr. Vail, although he had retired from the telephone field many years before. Desire to give the public the best possible service was almost a passion with him. "The prerequisite of a telephone service," he said in one of his annual reports, justly famed for their fullness and frankness, "is that it should be a continuous, immediate service, free as possible from any interruptions, and it must be possible for anyone in any one place to get into personal conversational communication with anyone in any other place. Any other service would be limited service." Again he said: "We recognize a 'responsibility' and 'accountability' to the public on our part, which is something different from and something more than the obligation of other public service companies not so closely interwoven with the daily life of the whole community."

THEODORE N. VAIL

It was Vail who brought the American telephone service up to its high plane in the days before federal control, who gave to American telephone subscribers coast to coast service, who for the short time he was head of the Western Union gave the American people the night letter and the week-end letter.

Mr. Vail was a staunch advocate of the theory of private control of public utilities. He was in sympathy with government regulation, but he was firmly convinced the government has no legal right to go beyond that point. He foresaw an attempt on the part of the federal government to take over the control of the telephones long before the war necessity arose. He then warned the American public what to expect, and he lived to see his prophecies fulfilled.

Theodore N. Vail was born in Carroll County, Ohio, on July 16, 1845. Stephen Vail, an uncle, founded the Speedwell Iron Works near Morristown, N. J., where was built the machinery for the first steamship which crossed the Atlantic Ocean. At these works Samuel F. B. Morse perfected and first operated the magnetic telegraph.

Theodore N. Vail was educated at Morristown, N. J., and after leaving school read medicine for two years with an uncle. During that time he acquired a working knowledge of telegraphy in a local office. When the family migrated to Iowa he went with them. In about a year he took a position with the Union Pacific Railroad and became an agent and telegraph operator at a small station on that line. In 1869 he became a clerk in the railway mail service, where his ability to systematize and organize was soon felt. Seven years later he was appointed general superintendent of that service.

In 1878 Mr. Vail was approached by Gardiner G. Hubbard, father-in-law of Alexander Graham Bell, and offered the position of general manager of the American Bell Telephone Company, formed to exploit the newly invented telephone. Mr. Vail accepted the position and immediately set himself to the task before him. He had visions of long-distance telephony far in advance of anyone else and one of his first achievements was to establish a line between Providence and Boston. Upon his initiative, improvements were made in telephone equipment and material so that little by little obstacles were overcome and long-distance telephony extended, until to-day New York talks to San Francisco.

In 1885 Mr. Vail resigned as general manager of the American Bell Telephone Company and was elected first president of the American Telephone & Telegraph Company. He resigned this post in 1887, and three years later he also resigned the presidency of the Metropolitan Telephone & Telegraph Company of New York and, retiring to a large farm in Vermont, settled down to the raising of blooded stock. Later he spent some years abroad, and in 1893 he made a trip to South America. He organized an electric street railway at Buenos Aires for British capitalists and for some time had his headquarters in London, returning to his Vermont farm in 1904.

In 1907, urged by prominent officials of the Bell Telephone Company, Mr. Vail re-entered the telephone field and again took the presidency of the American Telephone & Telegraph Company. In 1910, the Amer-

ican Telephone & Telegraph Company having acquired a controlling stock interest in the Western Union Telegraph Company, Mr. Vail became president of the latter company and proceeded to reorganize it along the lines which he had applied to the telephone business, greatly increasing its gross revenue, rehabilitating its equipment, and giving to the public new and improved service. On April 15, 1914, the American Telephone & Telegraph Company having disposed of its interests in the Western Union by agreement with the government, Mr. Vail resigned from the telegraph company.

In addition to his business activities, Mr. Vail founded the Lyndon Agricultural School at Lyndon, Vt. He was also a trustee of the Boston Museum of Fine Arts and a director of the Boston Opera House.

Civil Engineers Vote Down Federation Plan for Civic and Welfare Work

THE American Society of Civil Engineers has defeated by letter ballot the proposal to co-operate actively with other engineering organizations in the creation of a comprehensive organization to secure united action of the engineering and allied technical professions in matters of common interest. This decision is the outstanding feature of the vote on the questionnaire, canvassed April 14, containing ten specific inquiries as to the future conduct of the society's external and internal relations. The questionnaire was based upon the report of the society's committee on development and on the joint conference committee report made by representatives of the four national engineering societies.

By its vote on the questionnaire the membership of the society has expressed its wish to become an active national force in economic, industrial and civic affairs, co-operating with other engineering and allied associations in promoting the welfare of the engineering profession, but in so doing it has refused to be a party with other organizations in the creation of the "comprehensive organization" for civic and welfare work provided for in the report of the joint conference committee and involving acceptance of the principle of a federated engineering body.

Public Utilities Have Passed Peak of Crisis, Says J. G. White

ADMITTING that the strain on public utility credit throughout the whole country has been severe and that the difficulty in financing extensions and improvements for the normal growth of the business has been a serious problem, it is none the less the belief of J. G. White, chairman of the boards of directors of the various companies that bear his name, that the industry generally has "passed the peak of the crisis" and, except in isolated cases, will not be so seriously affected as other lines of industry by the period of liquidation and readjustment in values which Mr. White considers inevitable. This result would be in accordance with the history of public utilities.

The annual report of the J. G. White companies for 1919, in which the above opinion is expressed, says further:

"The 'Management Corporation' has made satisfactory progress in securing from various commissions and other regulatory bodies increased rates for all public utility companies under its management to offset increased costs of wages, taxes and other operating supplies. Practically all of the public utility properties under its management show substantial gains in both gross and net earnings."

W. J. Canada to Head N. E. L. A. Engineering Department

PROPOSED changes in the constitution providing for the reorganization of the National Electric Light Association at headquarters in New York and material changes in the form of organization throughout the country have received final approval from the executive committee. The plan of reorganization will be submitted to the convention in May for approval.

In furtherance of the plan for equipping national headquarters with a staff of experts responsible for carrying out the work of the association, upon recommendation of the several committees, Executive Manager Aylesworth was authorized to establish an engineering department. He was also authorized to employ W. J. Canada, formerly of the United States Bureau of Standards, as engineering expert and to employ some other expert on inductive interference as consulting engineer.

The name of the Technical and Hydro-Electric Section has been changed to the Technical Section and authority has been granted it to take up research and investigation on cable dielectrics, an appropriation being made for the purpose.

Power Companies of Minnesota and the Dakotas Organize

CONSOLIDATION of the South Dakota Electrical Association and the Minnesota State Electrical Association into the North Central Geographic Division of the National Electric Light Association, this body to include also North Dakota, which was without a separate association, was perfected on April 13 at a conference of electrical men of the three states in the Hotel Radisson, Minneapolis, Minn.

The conference was addressed by George F. Oxley, director of publicity of the National Electric Light Association, who explained in detail the reorganization plans of the national body and who told of the benefits to be derived from the carrying out of the national and divisional programs.

Officers of the new division elected were: President, T. D. Crocker, Minneapolis General Electric Company; vice-president, O. A. Rofelty, Northern States Power Company, Sioux Falls, S. D.; treasurer, F. C. Hoffman, St. Paul Gas Light Company; executive committee, W. H. Ryerson, Great Northern Power Company, Duluth, Minn.; Henry Lee, Anoka (Minn.) Light Company, and F. D. Brown, Huron (S. D.) Light & Power Company, in addition to the officers. The office of the secretary was temporarily filled by M. Barnett of the St. Paul branch of the Northern States Power Company, it being the intention of the division to employ a paid secretary as soon as necessary arrangements can be made.

The annual convention of the North Central Geographic Division will be held in the Hotel Radisson, Minneapolis, June 16 and 17. Prior to that time an intensive membership campaign will be conducted.

New York Senate Urges Congress to Hurry Up with Water-Power Bill

A RESOLUTION urging Congress to expedite its action on the water-power bill now in conference so that it may become a law at the earliest possible moment was adopted last Monday by the Senate of the State of New York. The passage of the bill, it was held, will greatly augment the industrial welfare of New York State because the use of water power is much to be desired. It was also pointed out that the state reserves its rights, vested or otherwise, in and to the waters within the state and upon and along the boundaries thereof.

In this connection a number of bills relating to water power have been introduced recently by Senator Sage at Albany. Among them is a bill providing for "reasonable rental fees" for the division of water from Lake Erie or Niagara River or other boundary waters. One bill would authorize the conservation commission to determine the equitable rental which the Niagara Falls Power Company shall pay the state for water diverted from Niagara River in excess of 15,100 second-feet.

Grounded Neutral Favored at Meeting of Pittsburgh Steel Engineers

GROUNDING the neutral on large power systems was the subject of considerable discussion at the April 17 meeting of the Pittsburgh Section, Association of Iron and Steel Electrical Engineers, when Robert Treat, General Electric Company, presented a paper on this subject. Mr. Treat stated that the question should be considered from the standpoint of safety to life, continuous service and protection of apparatus. He thought that as far as the life hazard was concerned it made no difference whether the system was grounded, but that in most cases service could be better maintained if such were the case. Grounding the neutral converts excess potential into excess current and prevents the oscillatory action which may occur when the system becomes accidentally grounded. Electrostatic disturbances are difficult to combat, he said, when there is no ground made. However, Mr. Treat thought that solidly grounding the neutral may result disastrously, so that it is preferable if some resistance is interposed between the neutral and ground.

In reference to results from an internal fault in generators when the system is grounded, the speaker said that if such an accident did occur, the resulting damage in the generator would not be emphasized because the ground was present.

Considerable advantage, it was pointed out, attaches to the fact that an accidental ground on a grounded system is immediately apparent, whereas on an ungrounded system a fault may be present for some time without detection. Furthermore, it is difficult to locate such a fault. On high-voltage systems arcing grounds are not immediately detected on ungrounded systems and insulator depreciation may result.

The central-station men and the representatives of manufacturing companies agreed with Mr. Treat that the grounded neutral was preferable in most cases, but the discussion resolved itself into the question of how large a system must be in order to justify grounding. The best way to decide, it was thought, is to operate the system ungrounded until a number of faults occur and then try grounding as a remedy.

F. S. Brown of the Duquesne Light Company told of how a good deal of trouble, such as generator fires, had been experienced by the Duquesne company before the system was grounded. At first it had been grounded solidly, but as this did not better conditions a resistance was placed in the grounding circuit.

It was pointed out that no company that has ever tried grounding the neutral has abandoned the practice on account of its non-success.

Super-Power Zones Urged by Mining Engineers' Committee

AS A MEANS for conserving coal and transportation facilities the committee of the American Institute of Mining & Metallurgical Engineers on coal economy through electrification of industries and railroads recommended that the Department of the Interior make an intensive survey of such zones in which the density of power requirements will support super-power systems. The committee, composed of W. S. Murray, chairman; W. S. Barstow, George Otis Smith and E. R. Welles, urged a definite national power policy along the lines of the establishment of super-power zones.

The inability of electric utilities because of regulation and taxation to obtain funds to increase capacity to keep pace with the increasing demand was touched upon, and because such conditions might later obtain when the engineering plans for the super-power zone are completed the appointment of a financial co-operating committee was recommended.

The personnel of the super-power committee of the A. I. E. E. appointed by President Calvert Townley was announced this week and is as follows: W. S. Murray, consulting engineer, New York,, chairman; H. W. Buck, of Viele, Blackwell & Buck, consulting engineers, New York; George Gibbs, of Gibbs & Hill, consulting engineers, New York; John W. Lieb, vice-president New York Edison Company, New York; Malcolm MacLaren, professor of electrical engineering, Princeton University; William McClellan, vice-president Cleveland Illuminating Company; Charles S. Ruffner, vice-president North American Company, New York; David B. Rushmore, General Electric Company, Schenectady; Charles F. Scott, professor of electrical engineering, Yale University; Percy W. Thomas, consulting engineer, New York; Harold V. Bozell, associate editor ELECTRIC RAILWAY JOURNAL, secretary.

Illuminating Engineers Plan Comprehensive Cross Index of "Transactions"

COMPILATION of an index and a cross index of the Transactions of the Illuminating Engineering Society since its beginning has been decided upon by the society. There is a strong feeling that individual publications should be available on each separate subject of illumination, such as photometry, color, glare, etc. The council of the society has this under consideration with the idea that if the society undertakes such work these publications will be brought up to date each year. The society feels that it should be in a position to supply quickly information relative to the developments in each phase of illuminating engineering.

Co-ordination of Engineering Interests Advanced in Chicago

PLANS for co-ordinating the efforts of all the engineers in this country were considerably advanced by meetings in Chicago this week between engineers of the Middle West, represented by the Western Society of Engineers, and the presidents of the four founder societies. The Western Society of Engineers invited these four national engineering societies to hold board meetings simultaneously in Chicago on April 19 and 20. At this time plans were discussed for establishing closer relations between all engineers and for making them better able to serve the public. The Western Society of Engineers tended a banquet to the visitors on Monday evening, when about 350 engineers and their wives listened to addresses by some of the leading engineers of the country.

Speaking at the banquet, Calvert Townley, president of the American Institute of Electrical Engineers, said: "Engineers, as a class, have yet to recognize the importance of team work. There have been many successful engineers, but they have won success by their own individual efforts rather than by any help from their fellows. Now, if we are to combine and do effective work it must be done for the purpose of rendering service to the city, state or nation and not for selfish reasons. They tell us it was an engineers' war; now let us make it an engineers' peace. The public cannot get along without us and they do not want to try, but we must recognize that it is our duty as citizens to devote ourselves to the progress of the country."

In discussing the plans for the formation of an association which would embrace the entire engineering profession of America, Fred J. Miller, president of the American Society of Mechanical Engineers, said: "It is generally expected that the joint engineering associations will deal almost entirely with the engineering aspects of problems of public concern without going too deeply into the public policy features."

California Power Shortage Less Serious

MARCH was the first month since September of last year in which rainfall in California was above normal. It has been estimated that each additional inch of rainfall from now on means $100,000 to each of the major power companies in California. The recent storm helped out the storage of the power companies, but does not begin to make up for the deficit in power shortage.

At a meeting of the San Francisco Electrical Development League April 12, H. G. Butler, power administrator of the California Railroad Commission, thus summed up the California power situation:

"In the southern part of the state the precipitation has been nearer normal than in the northern section and the supply of energy is proportionately greater. The watersheds are higher than in the north, and it is safe to say that if the agricultural and other loads can be shifed from night to day, no extensive new load taken on, and the resources carefully husbanded, it may be unnecessary to place restrictions on the south.

"In the northern part of the state the indications are that the Pacific Gas and Electric Company will have 10,000,000 kw.-hr. more than last year, but the upper reservoirs will not fill, and Lake Almanor, the chief reservoir of the Great Western Power Company, will only fill to 40 per cent of its capacity. Steam is a very uncertain factor, and to carry out the program these plants will have to generate 77,000,000 kw.-hr. per month, while the best they have ever done is 64,000,000 kw.-hr. per month, which was in August of last year. Stored water will be used to equalize the shortage over the seven months in which it will be felt. This shortage, based on estimated demand, will be 114,000,000 kw.-hr. for seven months, or about 10 per cent. The estimated demand is from 5 per cent to 9 per cent greater than for corresponding months of last year."

There are now under construction, or equipment has been ordered for, eleven plants for a total additional capacity of 208,000 kw. "All but 10,000 kw. of this will be available before low water next season," Mr. Butler stated, "and there are other plants in contemplation which could be completed by that time. So with a normal supply of water there should be no power shortage next year."

Scope of Work of Society for Electrical Development Told by Freeman

GOOD progress in its membership drive is reported by the Society for Electrical Development. The drive has been under way only a short time and already there are a number of applications coming in daily.

This week W. W. Freeman, president of the society, is sending out an open letter telling of the conditions in the society as he found them upon personal investigation prior to taking up the presidency of the organization. Of the results of this investigation Mr. Freeman says: "The scope and value of the work of the society during the past few years were far beyond my expectations, and I believe far beyond the realization of the electrical industry in general."

After pointing out that the society does not duplicate the efforts of any other existing organization, Mr. Freeman tells exactly how the organization functions.

The society will move next week from its quarters in the Engineering Societies Building to the Guaranty Building, 522 Fifth Avenue, New York, where slightly larger floor space will be had.

National Uniform Utility Accounting Virtually Assured

ALL public utility commissions will probably adopt a uniform classification of accounts as the result of a joint meeting in Chicago this week of accounting representatives of the National Electric Light Association, the National Association of Railroad and Public Utility Commissioners and the American Gas Association. As the National Electric Light Association and the American Gas Association had previously adjusted their accounting differences, their classifications of accounts were taken by the committee as a basis on which to work.

The first point agreed upon was that plant investment should not be segregated as of any fiscal date as is now the practice in some states. Then the National Electric Light Association and American Gas Association interpretation of retirement reserve was virtually agreed upon. There were sixteen representatives present at the meeting, which was still in session at the time the ELECTRICAL WORLD went to press.

Progress Made in First Meeting of Brotherhood with Contractors

A SPIRIT of good faith and confidence characterized the first meeting of the national council on industrial relations in the electrical construction industry, created through the joint actions of the National Association of Electrical Contractors and Dealers and the International Brotherhood of Electrical Workers, held in Washington last Tuesday.

A permanent organization was created by the national council, with L. K. Comstock of the contractors, chairman, and F. J. McNulty of the Brotherhood, secretary and treasurer. A committee on constitution and bylaws was appointed which is to report at a meeting to be held in New York April 30.

The council was fully conscious of the opportunity present for the assumption of a very helpful function of leadership, realizing that force would play no part in its programme and that it was entering a new field of activity. There seemed to be a feeling that the time had come when a method must be found for welding the interests of employer and employee in support of a single broad purpose which must give full recognition to the importance of building up the right relationship between the industry and the public.

Illinois Commission to Hold Hearing on High Cost of Financing

THE Public Utilities Commission of Illinois realizes that unless the utilities of the state are able to raise money promptly to finance indispensable extensions and enlargements to plants and equipment the public will be put to serious loss and inconvenience. In order to thrash out this problem and to find out what remedies the utilities and others have to suggest, the commission has issued an order setting two general hearings at which this entire question is to be discussed, in Chicago on April 29 and in Springfield on May 3. These hearings were requested by utilities which have been unable to finance extensions ordered by the commission and also by other utilities which have been unable to raise the money to finance additions and improvements that they consider necessary in order to keep up with the needs of the communities served.

In discussing this situation with a representative of the ELECTRICAL WORLD James H. Wilkerson, chairman of the Public Utilities Commission of Illinois, said: "The financial problems of the utilities of the state are independent of questions of their financial stability or of the rates charged for service. The companies say they are unable to get money by the sale of securities on any reasonable terms, and the commission has got to consider how far the utilities are to be required to make extensions under such financial conditions. The difficulties of the companies as presented to the commission are twofold. One difficulty is due to the general financial condition of the entire country. The other is local and has to do with the credit of this state where the misuse of public utility questions for political purposes has made persons with capital afraid to invest in the securities of Illinois' public utilities. In other words, the utilities which serve the public of this state are drifting into the condition of the railroads when they were unable to meet the demands of the public for adequate service. Very little new construction was undertaken by utility companies during the war, and additional equipment is needed to meet the greatly increased demands for all kinds of public utility service. Unless something is done promptly, the public will suffer severely."

Tentative Program for June A. I. E. E. Convention

THE tentative program for the thirty-sixth annual convention of the American Institute of Electrical Engineers, to be held at the Greenbriar Hotel, White Sulphur Springs, W. Va., June 29 to July 2, was given out this week. The convention will be opened with the president's address, followed by the presentation of technical committee reports. The following technical sessions will be held, presided over respectively by the chairmen of the committees named:

1. Electrical machinery committee (B. A. Behrend, chairman)—Symposium on temperature conditions prevailing inside large alternating-current generators; papers by Messrs. Torchio, Lamme, Foster, Fechheimer and Newbury and Gilman.

2. Protective devices committee (D. W. Roper, chairman)—Papers by Messrs. Steinmetz, Kierstead, Dwight and Gross.

3. Special committee on determination of power factor (S. G. Rhodes, chairman)—Preliminary report by committee and papers by Messrs. Holtz, Brown, Pratt, Silsbee, Wallace, Fortescue and Torchio.

4. Electrical machinery committee (B. A. Behrend, chairman)—Session on welding; papers by Messrs. Hansen, Bergman, Churchward, Candy, Turbayne and Miner.

5. Power stations committee (Philip Torchio, chairman)—Symposium on excitation; papers by Messrs. Bauhan, Ross, Vogel, and two others.

6. Miscellaneous session—papers as follows: "Alternating-Current Commutator Motors," by J. I. Hull; "High-Tension Insulator Porcelain," by W. D. Peaslee; "Wattless Power and Magnetic Energy," by J. Slepian; "The Corona Voltmeter—II," by J. B. Whitehead and Mr. Ishiku.

Radio Engineers Are Working on International Regulations

A COMMITTEE appointed by Secretary Alexander of the Department of Commerce is now ready to submit a report on proposed revision of international radio regulations which will be acted upon by an international radio congress at some future date. An encouraging aspect of the matter is that the government agencies have recognized the Institute of Radio Engineers by including the membership of its radio regulation committee, Dr. A. N. Goldsmith, chairman, in the Department of Commerce radio conference committee.

A protocol was drawn up by representatives of the United States, France, Great Britain and Italy proposing amendments to the London conventions of 1912 and submitted to the countries last summer for consideration. In this country the protocol is under consideration by the Army, Navy, Post Office and Commerce Departments, the latter representing commercial radio interests. It is said that the Department of Commerce committee will submit its report to Secretary Alexander on April 30, and that a general meeting will be held in Washington on May 13 at which the report will be publicly discussed.

Slight Improvement in New England Coal Situation

A CONFERENCE relative to the coal situation was held Tuesday at the office of the Massachusetts Department of Public Utilities by members of the commission and representatives of gas companies, electric service companies and the railroads. The railroad men present expressed their desire to facilitate coal movement to the utmost, but pointed out that it is at present physically impossible to transport a normal amount of coal into this district on account of the interruption of supply and freight congestion existing.

F. H. Smith, assistant general manager Worcester Electric Light Company, stated to the ELECTRICAL WORLD Wednesday that the outlook is somewhat improved for his company, as the railroads have delivered seven carloads a day to the Worcester plant since Monday from their own holdings. Conditions are better at tidewater central stations.

Commissions Must Allow Utilities to Earn More, Says M. R. Bump

RULES of regulatory commissions must be changed to allow a more adequate rate of return if the utilities are to attract the capital necessary for new equipment and extensions of their systems to meet the demand for service, M. R. Bump, chief engineer of Henry L. Doherty & Company, and vice president of the National Electric Light Association, stated to a representative of the ELECTRICAL WORLD this week in commenting on the credit situation of the electric light and power industry.

"There has never been a time, even during the height of the war," Mr. Bump pointed out, "when the demands upon central stations for additional service were as insistent and as great as they are today. Central-station power is practically without a competitor, and rates have ceased to be a controlling factor for the moment. The ever-increasing demand is for power and more power to meet industrial growth.

"At the same time, the investor, whose income depends upon the return secured from his investments, finds he must seek fields that are yielding larger returns than were formerly considered necessary, because, if his entire income is from investment, it is obvious that he must realize more from his capital to meet present living costs, taxes, etc.

"Central-station companies are therefore faced with a situation of providing additional capital to meet the present growing demands at a time when the cost of that capital is higher than it ever was before. Plant construction costs have more than doubled, and the rate for money has increased so materially that the fixed charges per unit of capacity installed today are from three to four times as great as in the pre-war period.

"The man who demands the services is willing to pay this charge, but in many instances no financial plan has been evolved that will permit the company to obtain the necessary capital for extensions. Very few of the state utility commissions have recognized this as a controlling factor. The rate of return which they permitted before the war upon investments made at that time is no longer an adequate return, for the very good reason that capital cannot be secured within the limits fixed by many commissions, and unless their rules in this respect are changed, it is inevitable that the central-station industry must suffer because of its inability to attract capital.

"It remains for the industry to meet the demands by placing its plight before every commission or regulatory body, stating its case clearly and plainly and proving beyond question the need of relief from the old basis in order that it may go on and meet the ever-increasing demands made upon it."

Lighting Company Allowed Temporary Rate Relief in Record Time

WHAT is probably a record for promptly meeting an emergency condition threatening the credit of an electric light and power utility was established by the Railroad Commission of California in a recent decision wherein a temporary rate relief was granted the Southern Edison Company six weeks after filing of application.

The unexpected subnormal rainfall conditions in California this year, making three successive years of subnormal precipitation, seriously reduced the output of hydro-electric plants, causing unusual increases in operating expenses to make up the deficiency, and because of this the Southern California Edison Company on Feb. 27 filed with the Railroad Commission an application for a temporary increase in its rates. Hearings were held in Los Angeles March 25, 26, 27 and 31, at which both the company itself and all of the cities and farming communities served by the company were represented.

Under date of April 15, the commission handed down a long decision allowing the company a temporary increase in all its rates of 27 per cent from April 20, 1920, to Jan. 20, 1921. This increase provides the company with an additional revenue during the period of $2,106,600, in partial compliance with the company's application for a 32½ per cent temporary increase. The temporary rates will be in effect pending the establishment by the commission of standard rates after a full and complete valuation.

The text of the decision says, in part:

It is increasingly evident that the business life of a community such as southern California is in a very large measure dependent for its growth and expansion, and in some instances even its continued operation, upon electric energy, and as the cost of steam generation is constantly increasing, the necessity for the cheaper production of electricity by hydro-electric development has become more and more recognized. Of course, it is not to be understood that the Railroad Commission urges the payment of unreasonable rates to stimulate investment in this public utility, but when it is considered that to place this company in a position where it can successfully finance will not result at this time in even an 8 per cent return on investment, it will at once be realized that the burden upon the consumer is not unreasonable. In considering the granting of an increase in rates of the amount herein contemplated, we are especially mindful of the fact that applicant has been diligently active in the enlarging of its production and transmission facilities since the consolidation of the properties in 1917. It has shown an active determination to carry on development and, from the evidence presented, has exerted every reasonable effort to meet the demands of the territory served in the face of difficulties arising from the war period of 1918 and period of readjustment and high cost of money, material and labor which have continued since. Applicant's evidence shows that it has definite plans for the development of both water and steam power for at least eight years in the future, and at an estimated cost of $100,000,000.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Quicksilver Produced in 1919. — The production of quicksilver in the United States in 1919 was 21,348 flasks, according to F. L. Ransome of the United States Geological Survey. This was a decrease of 11,535 flasks as compared with 1918.

Fifty Per Cent Increase in Minimum Rate Needed.—The Florence Electric Company of Oregon, whose plant was recently destroyed by fire, has applied for permission to increase its minimum rate from $1 to $1.50. Unless the increase is granted, the company asserts, it will be unable to rebuild its plant.

Getting Weather Reports by Radio.—The Kansas State Agricultural College is sending weather reports by radio six days a week for the benefit of rural residents who have wireless plants and who in turn transmit the reports to farmers in the neighborhood. In this connection it is reported that the government weather reports sent out from the wireless station at Arlington, Va., have been picked up by amateur operators living as far away as North Dakota.

Generating Electricity by the Use of Wind.—In Sweden there is a plant which combines ancient and modern power sources in an unusual way, generating electricity by means of wind. A windmill with four 18-ft. sails making thirty revolutions a minute produces 6.22 hp. when the wind has a velocity of 23 ft. a second. The wind lifts a 2-ton weight which in its fall develops the energy to drive the dynamo. The mill produces about 4,800 kw.-hr. a year, which is used for agricultural and pumping purposes.

U. of P. Adds to Its Electrical Equipment.—Recent additions to the apparatus of the electrical engineering laboratories of the University of Pennsylvania, Philadelphia, include a complete machine shop. The equipment is particularly adapted to the needs of research work. Additions to the laboratory equipment now on order include a 37½-kva. three-phase generator with driving motor, two direct-current 3-kw. interpole compound-wound generators with driving motors, field rheostats, tachometer equipment and measuring instruments.

Analysis of Complaints to Commission.—Verification of the California Railroad Commission's contention that an increase of rates under the abnormal conditions prevailing is an act of necessity, fair alike to the utility and the consumer, is seen in an analysis of the complaints received in 1919. With a total of 748 informal complaints to the commission regarding rates, electric companies were third on the list, there being 137 counts against them, and with 828 complaints regarding service, the electric companies again rated third, with 147 appeals. As there are approximately a million persons paying light and power bills in California, the number of complaints against service and rates is remarkably small.

Metropolitan Edison's Stock-Selling Campaign.—During April the Metropolitan Edison Company has been offering to its employees and customers a limited number of shares of 7 per cent preferred stock, par value $100, for $95 less interest on a monthly installment plan, or at $93 cash with accrued dividend. The offer is made to induce as many employees and customers as possible to become financially interested in the company, which announces earnings, after paying interest on its funded debt, of three times the amount necessary to pay the 7 per cent dividend on outstanding preferred stock.

Electrical Rules of International Electrotechnical Commission.—Vol. I of the "I. E. C. Rules for Electrical Machinery," as adopted at the plenary meeting held in Lndon, in October, 1919, has been issued by the commission and may be obtained from its secretary, whose address is 28 Victoria Street, Westminster, S. W., London. The publication comprises forty-two pages, the text being printed in French and English in facing paragraphs. Besides stating the scope of the rules, with definitions and I. E. C. rating, information to be given with inquiries and orders for electrical machines is printed, conditions to be fulfilled by electrical machinery are laid down and the markings of rating plates are signified.

Electrical Development in Japan.—Announcing the existence of 652 electric power companies in Japan, as of September, 1919, with a capitalization of $220,000,000, and the authorization by the government of 281 hydro-electric plants in nine months, with an aggregate rating of 452,000 hp., *Denkinotomo* ("The Electrician's Friend"), a Nippon contemporary, says: "The rapidity of the growth of water-power project was one of the marvels in industrial circle. The dawn of peace has given another dose to the ever-increasing demand on electric power. The higher price of coal and oil has acted coaxially with the natural growth of power demand. One of the grave questions confronting the far-sighted people in connection with water-power development is the desultory deforestation. The high price of lumber has caused the shiftless felling of forests regardless to the imminent danger to water source. Measures are being taken, however, to check the shiftless felling and to promote forestry, and it is hoped the ill tendency will be curtailed in time to come."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Society for Testing Materials.—The annual meeting of this society will be held at Asbury Park, N. J., June 22-25.

National District Heating Association.—The eleventh annual convention of the National District Heating Association will be held at the Hotel La Salle, Chicago, May 25, 26 and 27. A paper on the later types of bleeder turbines will be presented.

Society for the Promotion of Engineering Education.—This society will hold its twenty-seventh annual meeting on June 29 to July 2 at the University of Michigan, Ann Arbor. The general topic of the meeting will be co-operation. Ira N. Hollis, president of the Worcester Polytechnic Institute, will speak on "Co-operation with the National Engineering Societies."

Ohio Electric Light Association.—Coming committee meetings scheduled by this association are as follows: New-business co-operations committee, lighting and merchandising section and power and heating section, Coshocton, April 28; station-operating committee, Pittsburgh, May 5; meter committee, Columbus, May 7 (postponed from April 22). Arrangements are progressing for the Cedar Point convention, July 13-16.

American Association of Engineers.—The tentative program for the fifth annual convention of this association, which will be held at the Planters' Hotel, St. Louis, on May 10 and 11, has been issued. On the first day, besides committee reports and group meetings, the following topics will be discussed: "Shall a Special Charge for Special Service Be Made by the Employment Department?" "A Permanent Home for the A. A. E.," "Getting Pay Schedules Into Budgets for the Public Service Engineer," "What Part Shall the A. A. E. Take in the Presidential Campaign?" "Americanization and Man-Power Engineering," "Making the Chapter a Force in the Community," "The Federal Department of the A. E. E. at Washington," "Opportunities for the Engineer in Civil, Structural, Mechanical, Mining and Chemical Fields," "Co-ordinating A. A. E. Activities in the State," and "Reorganization of the A. A. E. on a Business Basis." On the second day amendments to the constitution and by-laws will be considered, "Unity of the Engineering Profession in the United States" will be discussed, and the annual dinner will be held.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Adjusting Loss by Accidents.—Unavoidable extraordinary expenses of an electric utility, such as those occasioned by lightning or a short circuit, should, according to a decision of the Missouri Public Service Commission, be charged to operation and amortized over a term of years.

Unnecessary Expenditure for Hauling Coal.—In granting increased rates for electricity and water to the municipal plant of Algoma, Wis., the Railroad Commission of Wisconsin pointed out that the city paid from $60 to $66 a month for hauling coal from the railroad to its plant, a distance of only 175 ft., and that the construction of a spur track at a cost of $500 would obviate this expense and save enough to offset a wage increase that had recently been made.

Ten-Day Discount Period Enough.—Declaring that the primary reason for allowing a discount for prompt payment of bills is not to obtain additional revenue through late payments, but to encourage early payments in order that the utility may itself be able to discount bills owed by it, the Wisconsin Railroad Commission granted an application from the Seymour Electric Company for authority to change its discount period so that it would expire on the tenth of each month instead of the twenty-eighth of each month as formerly.

Comparative Minimum Rates.—Complainants against a minimum residence rate of $1.50 adopted by the Northwestern Electric Service Company of Pennsylvania submitted to the Public Service Commission of that state for comparison the minimum rates made by seven electric companies in adjacent territory, which in two cases were 71 cents, in two cases 75 cents, in two cases $1 and in one case $1.25. The commission, finding that the cost of serving this class of customers had not increased 57 per cent, as would have been necessary to justify the new minimum rate of $1.50, reduced this rate to $1.20.

Increase of Rates with Change of Frequency.—Application having been made to the Wisconsin Railroad Commission by the Friendship Electric Light & Power Company for authority to increase its rates, the company alleging that a change was demanded from 133-cycle energy to 60-cycle energy, which would necessitate extensive reconstruction, the commission denied the plea on the ground that a substantial increase in revenue should result when the change was made and that increases in rates prior to improvement and enlargements are not justified unless present and past return has been unusually small and future prospects for a more profitable business are in no degree better.

Reasonable Rates for Large Electric Utility.—Among the pronouncements of the Missouri Public Service Commission in the matter of the application of the Kansas City Light & Power Company for increased rates—a case in which the commission overruled a motion for rehearing and mandatory proceedings covering a writ of review were taken in the Supreme Court of the state—are the following: (1) An estimate of a just and reasonable return to have been received by an electric utility operated in connection with a heating utility is adjusted, with the plant value and its application, to 50 per cent of the additions instead of the total monthly additions. (2) An electric utility having property of the value of approximately $8,139,319 is permitted to add a surcharge of 10 per cent to rates heretofore found just and reasonable where it was shown that the application of such rates results in a considerable loss to the utility, taking into consideration operating expenses, depreciation and return on the property. (3) Reorganization expenses assigned by the federal court to an interrelated electric utility in the reorganization of a bankrupt street railway are not, upon the unscrambling of interests in the joint holding company, to be capitalized by or amortized out of earnings of the interrelated utility in the absence of satisfactory evidence for such action or responsibility therefor on the part of the utility's consumers. (4) The value of the property of an interrelated utility formed for serving consumers across the state line and owned by an electric utility doing business in Missouri does not receive consideration in arriving at the value of the property of the utility for rate-making purposes to consumers in the latter state. (5) In estimating the operating revenues of an electric utility charges for energy furnished an interrelated utility were based on the production cost plus 17.7 per cent for losses and 10 per cent profit, although a lesser charge was made to the interrelated utility. (6) A net income of 7 per cent for return, surplus and contingencies on the combined property of an electric and heating utility is considered reasonable to a utility forced to pay 6, 7 and 8 per cent on short-time loans, as the net income should be somewhat higher than the cost of money. (7) An electric utility valued at $8,487,000, rendering adequate service and suffering a slump in return to approximately 3.32 per cent on account of increased costs of fuel, labor and materials, is permitted to increase its rates approximately 5 per cent.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Estimating Crop Damage from Flooding.—It was not an error, according to the Supreme Court of Minnesota, for a judge to instruct the jury that it might estimate the damage done to crops by the overflow of ditched water by the difference between the value of land with the crop and the value of the land without the crop. (176 N. W. 754.)

Excessive Penalties Imposed by Commission Illegal.—In an action brought by a railroad company to recover fines imposed upon it by the Railroad Commission of Florida, the Supreme Court of that state found that while the state may inflict penalties to insure obedience to lawful orders of the commission where no test of validity has been entered upon, it is none the less a denial of due process of law if a review of the legality of a statute may be had only at risk of penalties so great that it may seem wiser to yield to orders of uncertain legality. Rates or orders of the Railroad Commission do not have the attribute of finality and may be judicially reviewed, the court declared. (83 So. 708.)

Loss of Water Power Through Improvements on Public Canal.—The Court of Claims of New York State has dismissed an action brought by the American Woolen Company against the state to recover damages because of the temporary diversion of water while work on the barge canal was proceeding. The claimant asked that it be reimbursed for the cost of operation by steam power during two periods when the work on the canal deprived it of water power and also for the cost of constructing a new hydro-electric plant which it asserted was made necessary by the state's action and for the value of the use of the water power of which it was deprived during the year necessary to build the new plant, when the company was unable to use the old water-power machinery. The court found that diversion of water by cofferdam without any physical invasion of the lands or structures of a mill owner did not, as asserted by the plaintiff, constitute an "appropriation" by the state, and that a claim for damages could not be entertained by the court because the complainant had not, as required by law, filed a notice of intention to claim compensation within six months from the time of the accrual of any of the damages complained of. (180 N. Y. S. 759.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Reinier Beeuwkes, chief electrical engineer of the Chicago, Milwaukee & St. Paul Railway, with headquarters in Seattle, has been responsible for a substantial part of the work involved in the electrification of the Pacific Division of that road, which was placed in operation March 5, 1920. As recorded n the ELECTRICAL WORLD for March 13, page 619, this road is now electrically operated from Renton, on the western slope of the Cascades, to Harlowton, on the eastern slope of the Rockies, with the exception of a gap between Avery, Idaho, and Othello, Wash. Mr. Beeuwkes received his training in railroad electrification as assistant to C. T. Hutchinson, consulting engineer of the

R. BEEUWKES

Great Northern Railroad, while on the Cascade Tunnel electrification. Mr. Beeuwkes in his present position has had charge of the transition of the lines from steam to electricity, and to him belongs much of the credit for their successful operation.

Henry M. Brooks, who has for a number of years been connected with the Insull interests, most recently as manager of the bond and stock department of the Middle West Utilities Company, Chicago, Ill., has resigned to go with W. G. Souders & Company, an investment house, and will be stationed in their New York office.

Charles Warren Hunt a few weeks ago accepted the office of secretary emeritus of the American Society of Civil Engineers, having on his own request been relieved of the duties of the active secretaryship after twenty-five years' incumbency of that office. Dr. Hunt's active interest in all that pertains to the engineering profession at large has given him an influence and reputation transcending the bounds of his own association. In 1903, for instance, he supervised and directed the work of organizing the International Engineering Congress held at St. Louis in connection with the Louisiana Purchase Exposition. He has long served as a representative member in such bodies as the John Fritz medal board of award, the Engineering Foundation and the United Engineering Society. He was born in New York City sixty-two years ago.

Bancroft Gherardi, who was made chief engineer of the American Telephone & Telegraph Company on July 1, 1919, was elected vice-president of the company on April 11 of this year. Mr. Gherardi has served for a little more than twenty-five years as a telephone engineer. He started in the office of Col. J. J. Carty, then engineer of the Metropolitan Telephone & Telegraph Company, in 1895. In 1900, when the traffic engineering department of the New York Telephone Company was created, he was transferred to that work and in 1901 became chief engineer of the New York & New Jersey Telephone Company. When these two companies were consolidated in 1906 Mr. Gherardi was made assistant chief engineer of both. In 1907, when Mr. Vail became president of the American Telephone & Telegraph Company, Mr. Gherardi was made equipment engineer, later being promoted to be engineer of equipment and buildings and engineer of plant in charge of plant development and standardization of the Bell system. On July 1, 1919, he was appointed chief engineer of the American Telephone & Telegraph Company, a position he held until his recent promotion to the vice-presidency. Mr. Gherardi was born in San Francisco on April 6, 1873. His father, Rear Admiral Bancroft Gherardi, U.S.N., took a leading part in the laying of the first transatlantic cable as lieutenant in charge of the boat Niagara, which landed the American end.

B. GHERARDI

Romaine W. Myers, chairman of the California Industrial Lighting Committee, is one of the prominent consulting electrical and illuminating engineers of the West. The new lighting orders drawn up by his committee, now being put into effect by the California State Industrial Accident Commission, are recognized as among the most modern illumination codes enforced by any of the states. Mr. Myers was born June 14, 1880, and was educated in Oakland, Cal., his present home. He received his first technical instruction there at California College, later going to the University of Pennsylvania for post-graduate work, specializing in illumination engineering. After professional

R. W. MYERS

service with the Southern Pacific Company and the General Electric Company, San Francisco, he became associated as civilian engineer with the Engineer Corps, U. S. A., and for five years had charge of all electrical work on the fortifications of the Pacific Coast and Hawaii. As private consulting engineer he has had much to do with the design of illumination installations in the industrial plants of California, as well as in the schools and the great Oakland Civic Auditorium. Mr. Myers has long been an active member of the Illuminating Engineering Society, being the Western representative of that organization.

W. L. MacFarlane has been appointed general manager of the Cornwall Street Railway, Light & Power Company, Cornwall, Ont., succeeding C. U. Peeling, resigned.

W. H. Smaw, who for a number of years held the position of purchasing agent of the Georgia Railway & Power Company, has resigned to accept the position of Southern sales representative of the Electric Service Company of Philadelphia. Mr. Smaw joined the Georgia Railway & Power Company in 1903 as assistant purchasing agent and was made purchasing agent in 1910. During the last eight years he has served in that capacity for both the gas company and the electric company.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Report on Combination of English Lamp Interests Ill Advised

ACCORDING to information received this week, little attention is being given now in England to the report by the sub-committee on trusts of the British Board of Trade which investigated the alleged existence of a harmful combination in the English electric lamp industry. The English electrical and engineering papers characterize the report as ill advised and apparently prepared from only a superficial investigation by members having no prior knowledge of the industry investigated.

The report stated that there was a combination known as the Electric Lamp Manufacturers' Association, created primarily in the interests of the British Thomson-Houston Company, a company controlled by American interests; the General Electric Company and Siemens Brothers, which includes from 90 to 95 per cent of the industry. Prices are fixed which become a national standard. These prices, it was held, were too high, as was the price of lamps imported last year from Holland. It was further stated that there was, as a result of this control, a limitation of output which was injurious to the public.

The fact that the largest of the three dominant member companies is under American control led the sub-committee to state that there was some danger of the interests of the British lamp industry being subordinated to American interests. Furthermore, it was stated that there is a possibility of an international combination comprising British, Dutch and American manufacturers, which would be able to control supplies and dominate prices over a considerable part of the world.

The Electric Lamp Manufacturers' Association of Great Britain has issued a statement taking exception to some of the statements contained in the report of the British Board of Trade. The public summary of the report is likely to be misleading to readers outside of England where it refers to the General Electric Company, which is in fact the General Electric Company, Ltd., of Great Britain, a competitor of the General Electric Company of America.

Rubber-Covered Wire Sales Hold at High Level

WITH one quarter of the year gone, manufacturers of rubber-covered wire are still holding the high rate of code wire bookings which they held over the first six weeks of the year. Orders received for total code wire for the first thirteen weeks of 1920 are estimated at $10,500,000. This is five and one-half times the volume estimated over the same period of 1919, and represents a booking rate for the year of $42,000,000. It was estimated that total code wire bookings for 1919 amounted to $21,000,000 (ELECTRICAL WORLD, Jan. 17, 1920, p. 160), and according to the records of the Underwriters' Laboratories, the production of rubber-covered wire in the United States in the year 1919, based upon the number of labels delivered, amounted to $22,341,000. The quantity estimated was 1,400,000,000 ft., or a figure 6 per cent higher than that of the Underwriters' Laboratories of 1,314,168,000 ft. Consequently double last year's rate is being accepted.

No. 14 solid rubber-covered wire has been ordered to an amount estimated at $4,200,000 for the first quarter of 1920. This is seven and one-half times that of the first quarter of 1919, but it must be remembered that last year only one-sixth of the No. 14 wire booked in the first half year was ordered in the first thirteen weeks. From April on the amounts of orders increased tremendously. Bookings of No. 14 are now averaging 40 per cent of the total code wire booked, which compares favorably with the figure of 38 per cent in 1919, first quarter. The booking of No. 14 code wire now is a smaller per cent of the total code wire being ordered than it was over the first six weeks. Hence it is reasonable to conclude that the ordering of larger current-carrying capacity code wire than No. 14 is increasing from month to month. Booking of total code is increasing, while the percentage which No. 14 bears to the total is falling off. Total code sales have been estimated at over a million dollars for each of the last two weeks.

Rubber-covered wire mills are running at a good capacity and as far as could be learned have sufficient stocks of raw materials to continue the production of this wire for some time to come. Shipping conditions now, of course, are extremely bad, and auto-trucks are being brought into play to make deliveries of the finished product. The mills can make virtually any shipments desired. If cars were available, 500,000 ft. of rubber-covered wire could be delivered tomorrow if it were necessary, or in one month or in six months. Shipments in general depend upon the necessity, and orders are being booked at that rate. The Mid-West is the best buyer at the present time, although the New England and Middle Atlantic States are taking a good volume of business.

Shipments of Copper and Brass Products Lengthened

IN the face of a heavy buying movement and a high volume of inquiries, the copper and brass mills are having their own troubles filling their orders. Several mills in the New England and New York territories are in whole or in part shut down because of labor troubles and shortage of raw materials and coal, while many mills which are running have only enough operatives to run one shift, with sufficient work on hand to run night shifts, too. One mill in particular is working four nights a week at full capacity until 9 o'clock, and has not enough labor available to run a regular night shift. Productive capacity is in general booked up to a heavy excess.

Shipments are long. If transportation were available now, the mills of course could begin moving much of the material that is piling up in their warehouses. Motor trucks are moving quantities of it, but this method is merely taking the edge off the stocks piling up and is taking care of only rather local traffic. The mills that are running are quoting from six to twelve weeks for shipments, while at least one of those shut down is not quoting any shipping date. Copper sheets and brass shapes are in a condition somewhat analogous to that of the steel industry. Hot copper sheets are in heavy demand and are carrying a six weeks' shipping date. Cold-rolled copper sheets can be turned out in about double the time.

There does not seem to be any immediate prospect of relief for the situation outside of a resumption of rail traffic. This, of course, will release pent-up finished stocks, but it will in no wise increase the supply of labor which

is necessary if more business is to be handled. Except in finished products, it is reported that little or no brass is being exported, the New England mills supplying domestic trade only. The electrical industry is taking more and more copper and brass tube, rod, wire and sheet, and it is expected that mill conditions and shipments will become increasingly more unsatisfactory as the summer advances. In connection with the export trade there is reported a heavy demand from India for sheet copper and brass for cooking utensils.

Prices of finished and semi-finished materials have held quite steady for several weeks. Copper itself has been holding within a cent of 19 cents all this year and so has had little effect in changing prices of its products. The price of copper is not likely to advance materially unless a heavy foreign buying movement sets in. It would not be surprising, however, to see a slight advance in the raw metal when domestic buying for the third quarter opens up. This would probably be reflected in higher prices of copper and brass products. At any rate, production costs, in particular in the mills where strikes are on if labor obtains an increase, are liable to have a greater effect in increasing prices of brass and copper products than advances in raw materials. Prices have been withdrawn where strikes are holding up production because of the uncertainty of future producing costs.

Trucking and Mails Help Delivery of Electrical Supplies

THE electrical supply trade in the neighborhood of manufacturers is faring better during the transportation tie-up than is the trade at a distance from them. Motor trucks are moving quantities of materials into jobbers' stocks and from jobbers' stocks out into the trade. Then, too, certain raw materials are being trucked in to manufacturers in quantities just about sufficient to keep up a small volume of output.

Boston jobbers are being greatly benefited by the concentration of shipments to Boston stock from electrical manufacturing plants in Connecticut and Massachusetts, resulting from freight embargoes outside New England. Switches, sockets, fuses, wire and some heating appliances are in better stock, but there is a famine in small-size rigid conduit, porcelain fittings and loom. The railroad strike did not make any serious inroads into local New England transportation service, but through freight, including coal and many raw materials, was cut into heavily by tie-up in New York and in the Middle West.

Motor-truck routes have been established from New York to Boston, Providence, Schenectady, Philadelphia and many other New England and Middle Atlantic States points. Truck rates, however, have advanced. One New York jobber considered sending a truck to Pittsburgh for pipe and found the rates had gone up from $1 per mile to $1.25 per mile. Houses owning their own trucks are not hesitating to travel long distances for their raw materials. Steel strip is being brought from Trenton to New York in quantities sufficient to allow the finishing mills to keep up a small volume of production of flexible armored conductor. The rate of production, however, is much too small to fill even daily needs. One jobber reports additional transportation costs of 15 per cent because of suburban trucking.

Virtually no steel, except for a small amount by truck, is moving to finishing mills, and production of rigid conduit is almost at a standstill. In one case where outlet boxes have been stamped out of strips of sheet steel, that supply has stopped and a few boxes are being made out of a small supply of large sheets on hand. This cannot last long, however.

The parcel post has been another life-saver. Electrical material is moving all over the country by that method, the only limit being that of dimension and weight. The New York post office is handling the greatest amount of parcel-post matter in its history and is adding men and trucks to take care of it. It is understood that that office will continue to employ additional men and trucks necessary to handle the increasing number of parcels. The main office and branch offices in the city are still piled up with packages, but it is reported that the situation is being handled better every day.

Among the shipments by post noted recently have been pole brackets, pins and other pole material of steel which have come from Chicago to New York and heating appliances in great number from New England to New York. Schedule material is a common commodity from New England points to stations all over the country.

With the increased demand for paper and corrugated paper containers for this class of shipment, it would not be surprising to find the supplies of that stock rapidly dwindling. One paper box mill near New York is shut down because of coal shortage, and packing materials are reported to be the shortest in stock of any of the materials required by one lamp factory to continue its output. In some quarters paper for paper-insulated power cables is short in supply. Insulation manufacturers seem to have a fair supply of paper for present needs, in so far as the probable life of the freight tie-up is concerned.

Freight yards are congested beyond all previous records. Once the switch engines are released for clearing up, it can hardly be expected that the unscrambling can be effected within two to three weeks. Many cars containing electrical apparatus and materials have been located in the yards, but they are so inaccessible that it is impossible to unload them to trucks. At the same time a large amount of material has been accessible in the freight yards and has been trucked in to destination.

American Manufacturers Find Ready Market in Mexico

SELLING American electrical goods in Mexico is both pleasant and profitable, according to Charles E. Sharp of St. Louis, who specializes on the sale of electrical and mechanical apparatus and supplies to firms south of the Rio Grande. He finds no prejudice against American goods, and says: "Mexican buyers have always considered them highly. Virtually all the electrical machinery and supplies shipped into Mexico during the war and even now are of American manufacture. German goods have always been of cheap grade and sold accordingly. Some little French and Swiss apparatus is imported, but practically none of English make.

"Money is so plentiful that part or even full payment is often given with an order for goods," Mr. Sharp continues. "Buyers, therefore, are asking new salesmen for production and credit references instead of the salesmen asking them. However, personality, recommendations from other Mexican buyers and service count more than the rating of Dun or Bradstreet.

"Lighting, power and transmission material and apparatus are in great demand. Some electric irons are sold, but labor is cheap and as a general rule few electrical household devices are used. Large orders are the rule because of the heavy stocks that are maintained to supply their local needs."

Mr. Sharp finds it a good business policy to encourage his Mexican customers to call on him for everything they need in this country. He goes on:

"Since the Mexican government took over the railways in 1913 it has been impossible to ship orders through from the United States to Mexican points without the execution of a bond for the return of the railroad equipment. As a result shipments are sent to forwarding agents on the border who accept delivery, pay freight to the border, reload the goods in Mexican cars, pay custom duties and put the goods through the custom house. Shipments by sea are handled in a similar manner by forwarding agents at the port of embarkation.

"Any one wishing to visit Mexico need not have the slightest fear of being molested in any way whatever. Trains are running on a normal schedule with regular Pullman equipment. All money transactions are made with coins, as there are virtually no bills in circulation. Sometimes one is forced to sacrifice on change because of the lack of

coins of small denomination. In addition to a passport a traveler will be required to produce an income-tax receipt for the current calendar year before he will be allowed to cross the border. By this ruling any one leaving this country at the beginning of the year is required to prepay his income tax, which under ordinary conditions would not be required until March 15. A knowledge of Spanish is desirable but not essential. Most of the electric light, power and street-railway companies have engineers who speak English."

Metal Market Situation

LITTLE change in position of the basic metals which are used in the electrical industry has taken place in the past week. As a whole the metal market has been extremely dull. Electrical manufacturers have been well booked up on most of their requirements for April, May and June, and buying in the last few weeks has been carried on mainly by a few of the larger consumers who needed a little more for the second quarter and by some of the second-hand dealers.

Within the past week there have been reported sales of 3,000,000 lb. of copper, mostly for May and June delivery. Virtually none changed hands for immediate delivery because of the impossibility of transporting it. Producers are not at all apprehensive over the future copper market, but on the other hand are not at all disposed to quote for deliveries beyond the end of June. They realize that second-quarter consumption is already virtually closed up on their books, and that as matters now stand third-quarter bookings can be made later on in the present quarter at a rate higher than consumers would be willing to pay at this time. When the buying for third-quarter does start in the first few consumers undoubtedly will obtain copper at a rate little above second-quarter quotations. Beyond that it is expected that prices will advance at least to 20 cents. Copper has been characterized as a metal the price of which is relatively lower than that of almost every other metal used in the electrical industry. Producers continually refer to the small margin now obtaining between cost of production and selling price.

Producers are quoting their nominal price of 19.25 cents a pound for April, May and June copper, delivered. In the open market there have been some recent sales of small amounts for from 18.50 to 18.75 cents. It is expected that deliveries of this cannot be made much within two weeks.

The railway strike is holding up shipments from the West to refineries in the East, besides deliveries to consumers. These consumers will have to get along as best they can with present stocks, which in most cases will probably be ample within the probable life of the tie-up. Where refineries have small stocks on hand, and some of them are now virtually not operating, a shortage of refined copper may be expected at the end of the next sixty-day refining period.

Lead is holding a quiet market, although the price is rather steady. Leading quotations give 9.25 cents, but it may be had in the outside market for a quarter cent less for nearby delivery and at about 8.75 cents for May delivery.

NEW YORK METAL MARKET PRICES

	April 14	April 21
Copper	£ s d	£ s d
London, standard spot	104 10 0	100 5 0
	Cents per Pound	Cents per Pound
Prime Lake	19.00	19.00
Electrolytic	19.25	19.25
Casting	18.37½	18.37½
Wire base	23.00	23.00
Lead, trust price	9.25	9.25
Antimony	10.75	10.50
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.75 to 8.85	8.35
Tin	63.00	61.50
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	16.50 to 17.25	16.50 to 17.00
Brass, heavy	10.25 to 10.50	10.25 to 10.50
Brass, light	9.00 to 9.50	9.00 to 9.50
Lead, heavy	7.50 to 7.62½	7.25 to 7.50
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

THE WEEK
IN TRADE

WITH railroads over the country moving perishable freight, with a shipbuilding boom starting in the Northwest, with increased building operations commencing in the South, and with supplies rapidly pouring into New York and Boston by parcels post and by truck, the outlook in the supply jobbing field is better today than it has been for a number of weeks.

Heavy demands in Chicago for building materials such as conduit, outlet boxes, wire, etc., are expected to be partly filled by delivery there of some freight before the week is out. On Tuesday 500 out of 765 switch engines were running, and much of the congestion there, it is thought, will soon be over. In Seattle contracts have been let for eighteen tankers of 10,000 tons or more, and business is normal. A slight decrease is reported from Portland. Boston and Atlanta have not suffered from the railroad tie-up as badly as other sections, although much freight for Boston from the West, passing through New York, has been held up. In New York, Boston and Chicago a considerable number of large buildings are going up, and this number is rapidly increasing. Demand for building materials is felt in all sections, with jobbers confident that a large amount of business will be transacted during the next six weeks.

NEW YORK

With virtually all railroads in the New York district again handling perishable freight, danger of a serious shortage of building materials has passed. Jobbers are optimistic about the amount of business to be transacted during the next month. This is dependent to a large extent, however, on the amount of conduit, flexible armored cable, outlet boxes, wire, porcelain knobs, tubes and switches that will arrive meanwhile. Considerable stocks of porcelain material, fuses, heating appliances and line hardware have been received during the week by parcels post. Both manufacturers and jobbers are using this method to good advantage.

Many truckloads of building materials have reached the city during the week. The present price of $1.25 per mile per truck for long-distance hauling has, however, prevented jobbers from bringing large quantities of materials over long distances. Jobbers who have been compelled to ship goods to the suburbs by truck find that shipping expense has increased 5 to 15 per cent.

Demand, as indicated by business contracted for on the first three days of the week, has shown improvement over previous weeks.

Fuses.—Demand is normal with fair supply on hand. Plug fuses in 10, 15, 20, 25 and 30-amp. sizes are $7 per 100 in less than 100 lots. List price on standard cartridge fuses up to 30 amp., 250 volt, is 25 cents; for 30-amp., 125-volt, 25 cents, and 35 cents for 60-amp., 250-volt. Discounts range from 30 to 50 per cent, depending on quantities. The 50 per cent discount is applicable to standard packages.

Lamp Cord.—Several jobbers have secured shipments of lamp cord. Supply generally is low. Cotton lamp cord, size No. 18, is quoted at $25 per 1,000 ft.

Non-Metallic Flexible Conduit.—Many jobbers are completely out. Some loom has been received during the week, but stocks are badly broken wherever any is to be had. Prices vary from $36 for 7-32-in. size to $40 per 1,000 ft. for ½-in. size in lots of 500 ft. to 1,000 ft.

Transformers.—Demand is heavy for distribution type, and local stocks are being kept up with difficulty.

Lightning Arresters.—Spring demands are being filled in good shape, and stocks of low and medium voltage pole-type arresters are holding out well.

Wire.—Rubber-covered wire bases have been holding at 28 and 30 cents. Two mills have just raised their bases from 26 to 28 cents because of increased labor charges, it is reported. Shipments from mills really depend on urgency of the order.

Outlet Boxes.—Demand continues heavy with extremely poor stocks from which to fill orders. The call for 3-in. boxes has fallen a bit, it is reported.

Conduit.—There is very little rigid conduit in the territory, many jobbers being cleaned out of stock. There is little prospect of relief until freight moves again in good volume.

Schedule Material.—Stocks are in better shape than those of the other kinds of wiring materials and supplies. Parcel-post shipments are helping the situation materially.

Flexible Armored Conductor.—Stocks are virtually non-existent. Mills are trucking in steel strip and producing finished conductor in small amounts.

BOSTON

Continued active business expressed in an almost overwhelming rush of orders and deliveries in a state of upheaval due to the railroad strike are outstanding features of the week in New England trade. Local jobbers benefited greatly by the concentration of shipments to Boston stock from electrical manufacturing plants in Connecticut and Massachusetts resulting from freight embargoes outside New England. Switches, sockets, fuses, wire and some heating appliances are in better stock, but there is a famine in smaller-sized rigid conduit, porcelain fittings and loom. Leading Boston jobbers are shipping lighter material from New York by motor trucks. Collections are improving this month. Prices are firm and unyielding. Jobbers report that central-station business is slow to develop this spring. Some talk is heard as to the need of higher lighting rates. A few industrial plants were shut down from coal shortage, but most electrical concerns ran through the week.

Fuses.—Fuses are in excellent stock. Prices are as follows on the standard non-renewable types: Plug fuses, up to 30 amps., 125 volts, $5.75 per 100 in less-than-carton lots to $4.75 per 100 in standard-package lots. Cartridge fuses, non-renewable, to 30 amps., 250 volts, 25 cents list, and from 31 amp. to 60 amp., 35 cents list, with the following discounts: Less than carton lots, 12 per cent; carton to standard packages, 23 per cent; standard packages, 42 per cent off. These discounts apply from list on all inclosed non-renewable fuses up to 600 amp. at 600 volts.

Flexible Armored Conductor.—Stocks are running low. One jobber received 50,000 ft. Friday, but even so, it is necessary to parcel out deliveries. Single-strip No. 14 is quoted around $110 to $115 per 1,000 ft., with $120 on double-strip. The demand far exceeds the supply.

Non-Metallic Flexible Conduit.—The market is almost bare of loom for the time being, some of the larger houses reporting no stocks. Nominal quotations are steady at $37 per 1,000 ft. on 7-32-in. and $40 for ¼-in. Shipments into this district are bad.

Wire.—Bare copper wire is steady at 24 cents base and weatherproof at 28 cents. Rubber-covered wire is in good supply in eastern New England, a representative price being $16 per 1,000 ft. on No. 14 in less-than-coil lots and $13 in coils.

Porcelain Fittings.—Leading jobbers are virtually stripped of tubes and "Nail-it" knobs and are none too well supplied with cleats.

Sockets.—Heavy shipments are being made from Connecticut into Boston. Prices hold firm, with pulls at 50 cents, keys at 28 cents and keyless at 26 cents net in case lots.

Motors.—Stocks of smaller-sized motors are of poverty-stricken size. Few motors below 50-hp. rating can be had except on from four to five months' delivery from the factories.

Washers and Cleaners.—Jobbers representing New England producers are receiving these outfits in quantity, owing to embargoes on outside railroads. It is not expected that stocks will hold up long, but the strike has not been without its compensations. Retail deliveries are correspondingly stronger.

Fiber Conduit.—Business is rather dull. Quotations are on the basis of list less 12 per cent in small quantities.

Lamps.—Immediate requirements are being well met, notwithstanding a shortage in gas-filled lamps of larger sizes. Regional factories help.

Hollow Ware.—Shipments to Boston are in prospect from New England factories hitherto able to dispatch goods to all quarters, thus affording temporary relief to an active buyers' market.

Rigid Conduit.—The market is practically bare of ½-in. and ¾-in. pipe. Deliveries are at the lowest ebb for months.

CHICAGO

The railroad strike has each day been of varying intensity for the past week, with conditions steadily improving, so far as southbound shipments are concerned. Necessarily, foodstuffs are receiving first consideration in the clearance of congestion, electrical dealers and manufacturers getting small consideration. Coal shortages resulting from the strike have not caused many shutdowns in Chicago, but the situation is serious.

Placing of new business continues in heavy volume. Banking interests, which in the past have feared that the approaching return of business to a condition more nearly normal would be in the nature of a sudden crash, express the opinion that indications are for a gradual readjustment. Electrical manufacturers seem to share in this opinion. The proposed $15,000,000 bond issue to cover street-lighting work in this city was defeated at Tuesday's election. The fact that economy rather than disapproval of the improvement was the cause of its failure is borne out by the simultaneous rejection of large issues for needed bridges, a convention hall and playgrounds.

The week's building undertakings in the city amounted to $1,750,000. Of this amount only $300,000 goes in residences and $100,000 in an apartment building.

Bare Copper Wire.—Current quotation on No. 8 bare copper wire in 200-lb. lots is $26.25 per 100-lb., and on No. 12 is $26.50 per 100-lb. In larger quantities prices are $25 and $25.50 respectively. This is merely following fluctuations of electrolytic copper.

Second-hand Apparatus.—Dealers are unable to maintain stocks in the face of heavy demand, particularly for all sizes of motors from fractional up to 25 hp. or 30 hp. Certain concerns report March as the largest month in their history as regards actual sales.

Electric Trucks.—Manufacturers report business as excellent, though subject to inconvenience from the rail strike. Plants are running double shifts in an attempt to make prompt deliveries.

Sockets.—Demand is so heavy as to keep dealers' stocks continually at a minimum. Prices which have been in effect for some time are as follows: Key, $28.05 per 100; keyless, $25.50 per 100; pull chain, $51 per 100. These are for standard package lots.

Flexible Armored Conductor.—Jobbers and manufacturers are booked up to such an extent that orders are being taken only on the basis of price ruling at date of shipment. Jobbers' stocks are very low and factory deliveries uncertain.

Black Conduit.—Certain manufacturers are now working on new card No. 45, which is eight points higher than No. 44. A short time will probably see all prices uniform on the new basis. Jobbers have vast quantities on back order and new business is being placed to be billed at prices ruling at time of shipment.

Insulating Varnish.—Steady, heavy demand with plentiful supply and prompt deliveries is the feature of satisfactory business in this line. Prices remain on the same base as for some months past, but advanced costs of raw materials point to early increases, particularly in asphaltum products.

ATLANTA

Jobbers report that the railroad strike has had a noticeable effect on the receipt of material only in isolated cases, though they have had numbers of communications from manufacturers stating the latter's inability to make shipments. Failure to receive material on account of the strike will be noticed in from ten days to two weeks from date. Freight embargo and car shortage have seriously affected local jobbers, particularly in the heavier lines, and stocks in general are becoming more and more scant as a result. This is particularly true in steel and porcelain lines.

The business outlook throughout the territory continues excellent and a spirit of general optimism prevails. This is reflected by the growing tendency of the small-town contractor to enter the merchandising field in addition to his contracting activities.

Wire.—Fair stocks of rubber-covered wire are in the territory, but weatherproof is in poor shape, some jobbers being completely out of the popular sizes with no immediate prospects of replenishing stocks.

Motors.—Stocks of alternating-current motors are very scant, one of the largest jobbers in this line having none on hand. Great difficulty is reported in obtaining small sizes, particularly of the single-phase variety, and there are virtually no motors of the latter type in the territory.

Distributing Transformers.—The available supply continues to be comparatively fair, although stocks still remain somewhat spotty. Sizes up to 50 kva. can be obtained with reasonable promptness, but the large units are quoted at from eight to fourteen weeks.

Oil Switches.—The supply of the popular sizes of oil switches is very low, only a scattering of odd sizes being available, while shipments are being quoted at fourteen weeks for material not in stock. Price, 2,300-volt, 220-amp., $55.

Fixtures.—The demand is reported as holding up well and stocks are becoming depleted, owing to poor shipments. A price advance averaging 10 per cent became effective the first of the current week.

Porcelain.—Stocks continue in miserable shape. There are practically no tubes or cleats in the territory, although one jobber reports a big shipment of cleats in transit. Only one jobber reports sufficient supply of knobs to be worthy of mention, while the supply of rosettes and other porcelain material is very scarce. Manufacturers will make no promise of delivery.

Meters.—The demand for all sizes of meters is phenomenal, but house-type meters of from 5 amp. to 25 amp. are still obtainable in limited quantities from stock. The larger sizes of the low-voltage and all sizes of the high-voltage equipment are hard to obtain, shipments on 2,300-volt apparatus being quoted at fourteen weeks.

Schedule Material.—Practically no class of schedule material is on hand in sufficient quantities, the most acute shortage existing in boxes, sockets and material containing porcelain.

Fuses.—Jobbers report scant stocks of both plug and cartridge fuses, while the demand is strong. Such stocks as they have are very spotty and shipments are unsatisfactory. Plug fuses sell in lots of fifty at 6.3 cents each, while standard packages are 5.05 cents. Cartridge fuses in standard packages, 1 amp. to 30 amp., are 14.5 cents; 35 amp. to 60 amp., 22.5 cents; 65 amp. to 100 amp., 52 cents; 110 amp to 200 amp., $1.16; 225 amp to 400 amp., $2.08; 425 amp. to 600 amp., $3.20.

SEATTLE—PORTLAND

Conditions in the electrical business in the Northwest show no particular change. Both jobbing and retail trade is good, being restricted, however, by extremely slow shipments from Eastern factories and depleted stocks. The Portland district intimates that the volume of sales shows decreases and further decreases in prospect. However, this is not true in Seattle, where demand for schedule materials, domestic appliances, small motors, wiring devices and fixtures is steadily on the increase. Prices are trending upward, although no startling changes were noted during the past week. Improved weather conditions are expected to release materials en route, thereby solving to a considerable extent shortage problems which are overwhelming jobbers.

Renewal of steel ship construction in the Northwest is assured by award of contracts for eighteen 10,000-ton tankers.

Portland district reports that there has been little change in business during the past two weeks, although the general impression seems to be that it is gradually falling off. Credit is inclined to be a little bit tighter than formerly, and collections from some sources are reported appreciably harder to make than they were a few weeks ago. Pole-line hardware has advanced 20 per cent, and an advance is also reported in insulators. Both copper and conduit show a very strong upward tendency, although no advance in prices has been announced. There is a great deal of hesitancy shown about building more homes, although the shortage is pronounced. Large quantities of merchandise are already on order which, it is felt, will not arrive before late next fall. Retail business continues just as good as it has for some time past, featured by sales of domestic appliances. Sales of fractional-horsepower motors are being maintained, although stocks are depleted and shipments hard to obtain.

Lamps.—An exception to the general shortage of merchandise in the Northwest is the lamp supply. In the smaller wattages stocks are exceptionally good, but the demand is showing a constant dropping off. Stocks in the 100-watt size are in good shape in spite of steady demand from industrial sources. Sizes ranging from 100 watts to 300 watts are in fair demand and stocks are ample.

Batteries.—Considerable stimulus is noted in the buying of the past two weeks and stocks are very low. Shipments are long. Prices are tending upward, although no unusual change has been noted.

Glassware.—Demand is showing a gradual increase in face of a shortage in stocks and extremely indefinite deliveries.

SAN FRANCISCO

Freight embargoes caused by the switchmen's strike have sorely hurt Western shippers, who are not only hampered by tied-up Western shipments but are harassed by a local strike of their own. The Great Western Power Company, as well as the Pacific Gas & Electric Company, has appealed to the California Railroad Commission for permission to raise its power rates, claiming that the increased cost of fuel oil, among other items, has decreased its earnings. Heavy and widespread rains over the state have removed finally the fear of any serious drought.

Steel shortages have tied up some big buildings under construction in San Francisco and Los Angeles. The range campaign of the Great Western Power Company has been temporarily slowed down to await the arrival of Eastern stock. Recent range increases have put prices to a point that will require considerable explaining to consumers, justified though the increase may be by raw-material and labor conditions. A standard household range of good quality now retails for more than $200. Water heaters have increased in price, but as they are practically unobtainable in the size generally sold, the price influence on business cannot be so apparent.

Porcelain Material.—Household porcelain material is running true to form, with good stocks, which, however, will be heavily hit should the freight embargo continue. No. 5½ knobs sell for $15.90 per 1,000 in barrel lots, ⅝-in. x 3-in. tubes for $10.53 per 1,000 in barrel lots.

Telephones.—The boom in apartment-house building has re-created the keen demand of several seasons ago for interphones or house telephones. Local stocks are only fair and shipments are slow. Save for an occasional extension, there is little call for rural telephones, and such accessories as bare galvanized iron wire have correspondingly suffered.

Switches.—Flush push switches are in tremendous demand; shipments for several weeks to come are sold.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Pocket Portable Alternating-Current Meters

The Roller-Smith Company, 233 Broadway, New York City, has just put on the market type HA pocket portable ammeters, voltmeters and wattmeters for alternating current. This type of meter was designed, the manufacturers say, to meet the demands for small, inexpensive alternating-current portables similar in appearance to the type HD direct-current

THIS METER CAN BE CARRIED IN THE POCKET

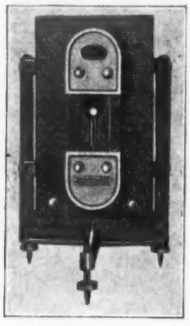
meters and comparable with them in both quality and price. This type HA comprises ammeters up to and including 50 amp., voltmeters as high as 300 volts and direct-current and single-phase wattmeters with maximum capacities of 30 amp., 300 volts. The ammeters and voltmeters are of the electromagnet type and the wattmeters of the electro-dynamometer type with efficient air damping. The construction is durable and rugged and the entire mechanism is mounted on one base. The manufacturers state that practically all these instruments are so designed that they may be used on direct current also with good accuracy, this being particularly true of the ammeters and wattmeters.

Sterilizer Heating Element

The Halverson Company, 180 North Dearborn Street, Chicago, has recently put on the market a new type of heating element for its medical and dental sterilizer. The sterilizer is equipped with a three-heat indicating switch, and the automatic safety fuse screw shuts off the current when the water is exhausted. The manufacturer asserts that it is a wet sterilizer, a dry sterilizer, a tumbler and atomizer warmer all in one. The dry-air unit has a temperature of 290 deg. to 300 deg. Fahr., has a separate heating element which is ready for service by turning an individual indicating switch, and can be used at the same time as the wet or boiling water sterilizer. It is made in 10-in. and 12-in. sizes.

Direct-Current Galvanometer

Direct-current galvanometer No. 2,000, manufactured by the Pyrolectric Instrument Company, 636-640 East State Street, Trenton, N. J., is a new instrument designed upon thoroughly practical lines, making it a general purpose galvanometer of widest usefulness. Among other desirable features it embodies the following, says the manufacturer: Sensitivity is high, ½ megohm for each ohm of coil resistance; period is only two seconds when critically damped; deflections are proportional;



SIMPLE GALVANOMETER WITH EXCELLENT OPERATING CHARACTERISTICS

working system is always fully in view; a simple and new method of zero adjustment is provided; it has an unusually sturdy upper suspension practically non-breakable) and a long lower suspension that will not tangle; large coil clearance permits great ease in adjusting for working conditions; construction throughout has been such as to produce a very substantial instrument of simple form but excellent operating characteristics. It may be mounted on wall or on tripod.

When used in connection with lamp and scale reflection indicator it is said to furnish a most desirable instrument for general electrical laboratory use and for research work. The coil resistance is only 16 ohms; total resistance between binding posts, 28 ohms; length of upper suspension, 4 cm.; upper suspension made of 1½-mil phosphorous bronze strip; length of lower spiral suspension when straightened out, 10 cm.; lower suspension made of 1-mil copper strip; volts at galvanometer terminals required to produce a deflection of 1 mm. on a scale 1 m. from mirror, 0.27×10^{-6} volt; current through galvanometer to give 1 mm. deflection on a scale 1 m. from galvanometer mirror, 0.094×10^{-6} ampere; resistance with which galvanometer must be shunted to produce critical damping, 6 ohms; figure of merit (based on formula 11, page 356 of "Methods of Measuring Electrical Resistance" by E. F. Northrup) is 2.4 d'arsons.

White-Glass Bathroom Fixture

The marble-like appearance and simplicity of design of the "Aglite" lighting units manufactured by the Luminous Unit Company, St. Louis, Mo., make them especially suited for use in bathroom, hospitals, etc., in the opinion of the maker. All visible parts are made of white glass, thus eliminating the annoyance of tarnishing or discoloring. The type illustrated here is equipped, besides, with a pilot-light lamp.

Small Direct-Current Ammeters

Although designed for use on automobiles, the type BI ammeter, recently placed upon the market by the Westinghouse Electric & Manufacturing Company, is applicable for use on motor boats, yachts, small direct-current switchboards and for charging batteries. This instrument utilizes the portable vane construction, comprising a moving soft-iron vane polarized by a stationary permanent magnet and deflected over its scale by the action of a stationary current coil. No springs or moving coil are used, thus resulting in great simplicity and ruggedness. The indications are made dead-beat by means of an efficient damper.

As the coil of this meter is below the movement, the electromagnetic

POLARIZED VANE CONSTRUCTION USED IN THIS METER

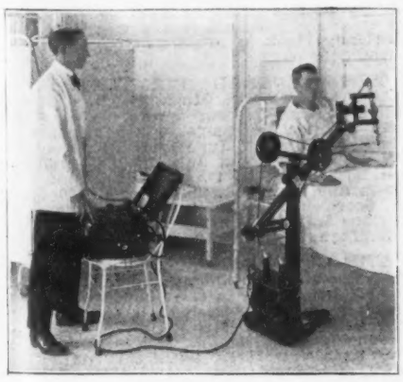
field from the coil does not pass through the magnet sufficiently to affect its strength at short-circuit current values which can occur. The meter is mounted in an open-faced circular pressed-metal case arranged for flush mounting. The terminal studs are for rear connection. The instrument is furnished in sizes of 0 to 15, 0 to 20 and 0 to 30 amperes.

A Portable X-Ray Outfit

Dr. W. D. Coolidge and his associates in the Research Laboratory of the General Electric Company at Schenectady have recently perfected a portable X-ray. It is now possible, the manufacturers say, for any doctor to transport the entire new outfit, packed in four hand-borne units, to any home wired for electricity, or to the hospital bedside, and produce ratiographic results as good as those secured in a completely equipped X-ray laboratory. The process of operating the machine is simplified for him by control systems enabling him to use the exact ray intensity he needs and a time switch that accurately controls the length of each exposure.

The portable Coolidge set has been greatly compacted and simplified over the army type familiar to medical corps men. The bulb itself has been reduced in size to 2½ in. By making the tube of thick lead glass, thus replacing a heavy lead shield, the total weight of the tube and its protection was reduced 5 lb. with a consequent lightening of the frame which supports it. This lead glass, made from a formula developed in the Schenectady laboratory, contains about 57 per cent metallic lead and in its resistance to X-rays is equal in protective power to lead ⅛-in. thick.

The new tube rectifies its own current, thus doing away with a heavy, bulky rectifier and adding to the efficiency of the set as a whole. The transformer has been reduced in size by the use of smaller windings and a case shaped to fit the coils. A minimum of weight and bulk is secured in all other parts of the outfit by a careful choice of materials and a study of sizes and shapes. Thus, when the outfit is ready to be taken out for use,



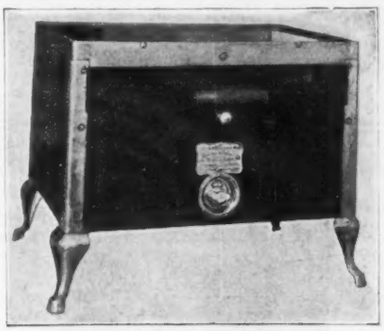
SIMPLE AND COMPACT PORTABLE X-RAY OUTFIT

the doctor carries an ordinary-size suitcase containing the tube, reels, cables, base of the stand and other small parts, the transformer borne by a special carrying cover, the tube stand in a cloth container resembling a golf bag and a small instrument and control box. The whole load is such as can be put easily into the tonneau of a small automobile and as easily carried in or out of a house. The transformer, which is the heaviest unit of the four, weighs 43 lb. with its case. It is oil-insulated and delivers to the tube 10 milliamperes at 60,000 volts.

One of the obstacles to radiography in homes is the variation in circuits between city and city or even between different parts of the same city. This is overcome by the control system of the portable outfit, by means of which it is possible always to deliver the same definite voltage to the transformer primary.

Utility Electric Heating and Warming Unit

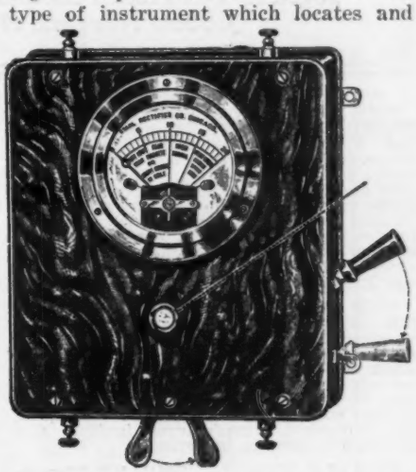
The Duparquet, Huot & Moneuse Company, 108 West Twenty-second Street, New York City, has placed on the market a new utility unit. It is essentially a toaster, with a capacity of twenty slices at a time, toasting on both sides at once. The top may be used as a griddle or fry plate. The unit is particularly adapted, the manufacturers say, to short-order business or hotels, lunchrooms, cafeterias, etc. It is also made with a warming compartment in place of the fry top. This compartment is heated by water, which is turn is heated by the upper heating element in the toasting chamber; consequently the heat applied in the warming chamber does not conduce to drying out the toast which may be stored there for reserve.



WARMING AND HEATING UNIT USEFUL FOR SEVERAL PURPOSES

Magneto Fault Finder

The Stahl Rectifier Company, 1,401 to 1,405 West Jackson Boulevard, Chicago has placed on the market a new type of instrument which locates and corrects faults in magnetos. The "Magfixer" is intended to take care of any troubles arising in the magneto of the Ford but will not take care of troubles arising in the wiring or in the ignition coils. It will, says the manufacturer, successfully recharge the magnets of the Ford magneto, regardless of the extent to which they have been demagnetized. The only condition under which it will not do this is where some of the magneto coils are broken down and grounded completely, owing to their insulation having burned off. In addition, the "Magfixer" will remove any shorts in the magneto due to pieces of wire, cotter pins, nails, etc., making contact between the coil connections and the case. It is also possible to detect any end play in the crankshaft of the Ford engine and to determine whether the magnets in the magneto have been installed in their proper order.



THIS INSTRUMENT LOCATES AND CORRECTS FAULTS IN MAGNETOS

Notes on Recent Appliances

Suspension Hanger

A new "Red Spot" suspension for hanging the Ivanhoe "Trojan" commercial lighting unit has been designed by the F. W. Wakefield Brass Company, Vermilion, Ohio.

Air Compressor

The United States Air Compressor Company, Cleveland, Ohio, has developed an electric air-compressor for garage use.

Resistance Unit

The Wirt Company, Germantown, Pa., has developed "Di-el-ite" resistance unit No. 42-B for heavy duty.

Lighting Unit

A lighting unit designed to eliminate the casting of dark shadows on the ceiling has been brought out by the Panama Lamp & Commercial Company, San Francisco, Cal.

Table Stoves

Four models of electric table stoves have been developed by the Bestov Manufacturing Company, Seattle, Wash.

Bake Ovens

The Duparquet, Huot & Moneuse Company, New York City, has developed electric bake ovens of the air-circulation type.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE BENJAMIN ELECTRICAL MANUFACTURING COMPANY has moved its San Francisco office from 590 Howard Street to 580 Howard Street, occupying the entire four-story building. This change to new and more spacious quarters has been made to provide room for the greatly increased stock now carried, which is needed to meet the demand of contractors and dealers who are being rushed by the great amount of building now going on all over the Pacific Coast.

THE WICO ELECTRIC COMPANY, formerly the Witherbee Igniter Company, of Springfield, Mass., has purchased seven acres of land in West Springfield. A new plant will be erected, the initial installation costing about $150,000. With the completion of the new plant the number of employees will be increased from 300 to 1,500. The company manufactures igniters and automobile storage batteries.

THE M. S. WRIGHT COMPANY, Worcester, Mass., manufacturer of "Sweeper-Vac" vacuum cleaners, has purchased the plant of the Mills Woven Cartridge Belt Company, 164 Fremont Street, Worcester. The productive floor space of the Wright company will be more than doubled and the force of employees increased from 650 to 1,300. The Cartridge company will lease for two years a section of the weave shed in order to care for its peace-time business.

D. GLEISEN, manager of the industrial bearing division of the Hyatt Roller Bearing Company, New York City, announces that its offices have been moved to a new building at 100 West Forty-first Street, where much larger quarters have been secured for the advertising, sales and engineering departments of the division

L. A. S. WOOD, prominent in illuminating engineering circles both in this country and in Europe, has been appointed manager of the illuminating section of the supply department of the Westinghouse Electric & Manufacturing Company, with headquarters at South Bend, Ind. Mr. Wood was born in London, and received his education at the University of London, afterward studying electrical engineering under Prof. Sylvanus P. Thompson at Finsbury Technical College. He was connected with the Edison and Swan United Electric Light Company in the early days of the incandescent lamp and later devoted many years to the development of the arc lamp. He took a leading part in laying out street-lighting systems in the larger European cities and also the lighting of many public buildings for the British government. He came to the United States in 1911 to introduce the flame carbon lamp and was shortly afterward appointed as arc-lamp expert of the Westinghouse Electric & Manufacturing Company, with headquarters at East Pittsburgh, Pa. Soon after the introduction of the "Mazda C" lamp he became associated with the George Cutter Company of South Bend, Ind., as illuminating engineer, and during the past nine years has traveled extensively, taking an active interest in street-lighting improvements in all parts of the country.

WALTER S. HOYT, who has been for two years assistant to C. A. Greenidge, chief engineer of the J. G. White Management Corporation, New York City, has become sales engineer of the Graphite Metallizing Corporation, Yonkers, N. Y., which manufactures oilless bearings and impregnates carbons for brushes.

THE INNOVATION ELECTRIC COMPANY, New York City, has transferred its vacuum cleaner business to the Electric Vacuum Cleaner Company, Cleveland, Ohio. Frank N. Davison, sales manager of the Innovation company, has become sales manager of the Appliance Distributing Corporation, 673 Eighth Avenue, New York City, distributer of electric appliances.

THE ALL-STEEL-EQUIP COMPANY, Aurora, Ill., manufacturer of electrical boxes and specialties, etc., has issued a new price sheet, No. E-25, on its outlet box covers. The principal point of interest in this sheet is that it shows the addition to its line of the several "approved" covers, and also the addition of covers to take the P. & S. sign receptacle. Previous covers were unapproved, while now all covers are made in the approved style.

GEORGE BAILY, formerly manager of the supply division of the Cincinnati office of the Westinghouse Electric & Manufacturing Company, has been appointed industrial assistant to the manager of the supply department of that company at East Pittsburgh, Pa. Born and educated in Baltimore, Md., Mr. Baily served on an engineering corps in Baltimore and on the United States Engineering Corps in 1898.

GEORGE BAILY

Later he spent considerable time with the United States Geological Survey. After being graduated from Lehigh University in 1904 as a civil engineer, he became associated with the Dravo Construction Company of Pittsburgh, where he remained until 1910, at which time he went into business for himself in Cincinnati as sales agent and contracting engineer. He remained in this occupation until 1913, when he joined the Westinghouse organization.

THE ELLIOTT COMPANY, Pittsburgh, Pa., manufacturer of power accessories, is now placing upon the market an apparatus which removes substantially all of the air and dissolves gases from boiler-feed water.

THE AMERICAN STEAM CONVEYOR CORPORATION, Chicago, has developed an air-tight ash-pit door which has a number of features that make it attractive to the power-plant engineer.

THE VOLTA BATTERY COMPANY, Indianapolis, Ind., has increased its capital stock from $10,000 to $100,000.

THE MITCHELL-RAND MANUFACTURING COMPANY, 18 Vesey Street, New York, announces that it has become the agent and representative of the Sterling Varnish Company and that it will sell its products at factory prices, making prompt deliveries either from a complete New York stock or from the factory direct.

E. B. BADGER & SONS COMPANY, 63 Pitts Street, Boston, Mass., announces that it has acquired the American Spray Company, including its engineering personnel. The American Spray Company manufactures spray ponds and air washers designed especially for cleaning the air used to cool generators.

THE POLLY MANUFACTURING COMPANY, 431 Chestnut St., Milwaukee, Wis., has been incorporated with a capital stock of $25,000 to manufacture and job popular-priced lighting devices. William Polacheck is president of the company.

THE AMERICAN EVER READY WORKS of the National Carbon Company at Long Island City, N. Y., announce the appointment of H. S. Schott as Eastern sales manager, succeeding J. H. Somers, resigned. Mr. Schott first became connected with the company in 1913 as a clerk, and after a term as salesman he was transferred to the Canadian Ever Ready organization, where he was promoted to be assistant sales manager.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, announces that on April 24 the New York office of the company, which has been for twenty-two years at 100 Broadway, will be removed to the National Association Building, 23-31 West Forty-third St.

EDWARD J. JEEP, for many years city sales manager of the Commercial Electrical Supply Company, St. Louis, Mo., has resigned and accepted a position with the Fairbanks Company, Seventh and Market Streets, St. Louis, as manager of its electrical department.

VANCE McCARTY, general sales manager of Edw. R. Ladew Company, Inc., manufacturer of leather belting, has been made vice-president of the company. Mr. McCarty's connections with the house of Ladew covers the past twenty years and embraces every phase of the leather-belting business, including manufacture, sale, branch management and general sales direction. He will continue in direct control of Ladew sales policies and has retained as assistant general sales manager Russell B. Reid, another Ladew belting expert with twenty years of leather-belting experience.

THE LUTHY STORAGE BATTERY COMPANY, 215 Emmet Street, Newark, N. J., is arranging for the removal of its plant to a new building in Frelinghuysen Avenue at an early date. A portion of the company's present works, including the boiler plant, was recently destroyed by fire.

THE ENGINEERING & APPRAISAL COMPANY, INC., 103 Park Avenue, New York, announces the addition to its engineering staff of Ralph G. Macy, who has been elected vice-president of the company. Mr. Macy has accordingly resigned as chief engineer of the construction department of the Walter Kidde Company. Mr. Macy has had a long experience in engineering and industrial work, and prior to the war was in charge of the operation of five plants making liquid oxygen and nitrogen. He was commissioned in the United States Army and ordered to Fort Worth, Tex., to construct the first helium-gas plant of the war establishment. Upon the completion of this plant he went to Aberdeen as ordnance-proof officer and was then sent to Sandy Hook as armament officer in the coast defence.

THE GENERAL ELECTRIC COMPANY'S WINDSOR PLANT.—The new addition to the Windsor works of the General Electric Company will be completed about the first of June and will be ready for occupancy about July 1. The building will be 200 ft. x 70 ft. and will contain two floors and basement, providing 40,000 sq.ft. of floor space. Small electric motors of various horsepowers for direct current are manufactured at the Windsor works.

THE GENERAL ELECTRIC COMPANY, owing to the unprecedented demand for electric motors to drive household equipment, machine tools, etc., has decided to use its Pittsfield (Mass.) works to aid in producing small motors, and is advertising for female workers with this object in view.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces that it has opened an office and warehouse at Jacksonville, Fla.

THE SQUARE D MANUFACTURING COMPANY, Detroit, Mich., has purchased the property of the Peru (Ind.) Electric Manufacturing Company, manufacturer of standard and special porcelain wiring devices.

THE MOHRLITE COMPANY OF AMERICA, Nashville, Tenn., recently incorporated, is planning to establish a $300,000 plant in Nashville for the manufacture of the Mohrlite reflector. W. M. Dixon, who has charge of the plant of the Mohrlite Company of Urbana, Ohio, will be in charge of the Nashville plant. Eventually the plant at Urbana will be removed to Nashville.

Supply Jobbers' Notes

THE JULIUS ANDRAE & SONS COMPANY, Milwaukee, Wis., celebrated its sixtieth anniversary with a banquet held Jan. 8. The event was attended by the executives of the Andrae organization, guests and a large number of co-workers. The evening was given over to a discussion of the potentialities of the electrical industry, the speakers paying a high tribute to the company in recounting its achievements and success. H. P. Andrae, president of the company, gave an outline of the different steps in the progress of the organization, commended the Andrae men on their efforts in making such remarkable showing last year and spoke enthusiastically on the outlook for even a greater year in 1920.

A. M. LITTLE, president of the Mohawk Electrical Supply Company, Syracuse, N. Y., who was elected chairman of the Atlantic Division of the Electrical Supply Jobbers' Association on Feb. 9, has been in the electrical business since 1889, starting with the Central Electric Company as office boy. For the last ten years he has been president of the Mohawk company, and for seven years prior to that time he was salesman in the eastern part of the country for Pass & Seymour, Inc., Solvay, N. Y. As chairman of the publicity committee of the

A. M. LITTLE

Electrical Supply Jobbers' Association, Mr. Little initiated the National Trade Journal Publicity Campaign of that association. He takes the stand that the greater publicity the supply jobber can secure, individually, as regards the personnel and the company itself and for the business as a whole, the more that end of the industry is advanced and brought to the attention of every one.

A. W. LINDGREN, for many years manager of the Duluth branch of the Northern Electric Company, having headquarters at Minneapolis, Minn., has announced the purchase by himself and associates of the Duluth branch of the Northern Electric Company. The name of the new corporation which is now being organized will be the Duluth Electrical Supplies Company. There will be no change in management, organization, location or policy. It is the intention to operate for the present in the same territory in which the Duluth branch of the Northern Electric Company has operated, although it is quite possible that the territory of the new company may be extended in the near future. The new company expects to maintain relations with the same manufacturers which the old company represented. The Duluth Electrical Supplies Company will be entirely independent, however, of all connection with any other jobber.

FRANK R. VENABLE has been appointed purchasing agent for the Montana Electric Company and the Washington Electric Supply Company, Butte, Mont. In 1907 Mr. Venable became purchasing agent for the Cœur d'Alene Hardware & Foundry Company, Wallace, Idaho, which handles Westinghouse equipment, remaining with that company until last December.

THE CARTER ELECTRIC COMPANY, Atlanta, Ga., held a meeting of its sales agents in Atlanta on April 6 and 7, approximately 125 dealers being present. In addition to the business meeting, when talks were made by well-known manufacturers' representatives, a dinner and theater party were tendered to the visitors by the company on the night of April 6.

Foreign Trade Notes

MUCH ELECTRICITY USED FOR DOMESTIC HEATING IN URUGUAY.—On account of the exorbitant prices for fuel, the use of electricity for cooking and heating purposes in Uruguay has become necessary. The Public Service Electric Company, owned by the national government, has maintained the low prices that were in force before the war, making it possible for the people of the country to secure the necessary heat for domestic purposes at a reasonable cost.

HIGH DEMAND FOR ELECTRICAL FIXTURES IN ONTARIO.—Because of the utilization of the water power in the Province of Ontario by the Hydro-Electric Power Commission, there is an increasing demand in that province for electrical fixtures and labor-saving equipment. American-made products command the market, and from large cities and rural communities served by the lines of the commission there is a call for more electricity to light houses and operate washing machines, vacuum cleaners and other modern appliances. While at the present time the demand is limited to this section of the Dominion, it is probable that similar developments will take place in other parts of the country at an early date, and a still greater demand may be expected.

Foreign Trade Opportunities

Following are listed opportunites to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A manager of a sales company in Spain (No. 32,470) desires to secure an agency and also purchase one or two electric autotrucks, equipped complete, capacities from ½ ton to 7 tons.

A commercial representative in Asia Minor (No. 32,471) desires to establish an American exhibit in that country of electrical machinery.

A firm of engineers and contractors in Siberia (No. 32,473) desires to get in touch with manufacturers and exporters in order to secure agencies in Russia and Siberia for electrical machinery.

An inquirer in Mexico (No. 32,490) who is about to establish a new bakery desires to purchase baking ovens that can be heated by electricity.

A firm of commercial representatives in Spain (No. 32,530) having an exclusive publicity and sales service department desires to receive from American manufacturers the exclusive agencies for the sale of supplies for street-railway cars.

Trade Publications

PUBLIC UTILITIES. — The Charleston Industrial Corporation, operating in the city of Nitro, W. Va., has published a booklet on the "Public Utilities of the City of Nitro." It gives a technical description of the various public utilities of Nitro which have been and are now in constant operation.

INSULATING VARNISHES AND COMPOUNDS.—The Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York, has issued a booklet giving prices and data of the Sterling insulating varnishes and compounds.

BRASS MAKING.—"Seven Centuries of Brass Making" is the title of a seventy-eight-page booklet issued by the Bridgeport Brass Company, Bridgeport, Conn. It contains a brief history of the ancient art of brass making and its early (and even recent) method of production contrasted with the electric furnace process. Illustrations are given showing anicent and modern methods of manufacturing brass and its products. Considerable space is given to the use of electric machinery and equipment in connection with the brass industry.

MACHINE-TOOL CONTROL. — Bulletin No. 100, issued by the Monitor Controller Company, Baltimore, Md., gives descriptions and illustrations of its Monitor automatic starter and other devices used in connection with the Monitor system of machine-tool control.

INDEXES.—The General Electric Company, Schenectady, N. Y., has issued indexes to its descriptive bulletins and sheets and supply-part bulletins, both dated January, 1920.

New Incorporations

THE CASTLEBERRY (ALA.) UTILITIES COMPANY has been incorporated with a capital stock of $20,000 by G. G. Kramp, and Robert A. Baird to construct an electric plant and ice factory.

THE COACO (FLA.) ICE & LIGHT COMPANY has been chartered with a capital stock of $50,000. The officers are: Fred Bryan, president, and S. F. Travis, secretary and treasurer.

THE NORTHERN NECK RAILWAY & POWER COMPANY of Fredericksburg, Va., has been incorporated with a capital stock of $5,000,000. The officers are: Willis H. Fowle, president; G. D. Happer, vice-president, and M. Glennon, secretary.

THE H. & H. STORAGE BATTERY COMPANY of Pawtucket, R. I., has been incorporated by Edward Hackney, Edwin Hackney and E. Butler Moulton. The company is capitalized at $10,000 and proposes to manufacture motors and electrical equipment of all kinds.

THE AUTO ELECTRIC SERVICE COMPANY of Montgomery, Ala., has been chartered with a capital stock of $20,000 by Henry C. Fite and others. The company proposes to conduct a general automobile and accessories business.

THE HUNTINGTON (IND.) ELECTRIC COMPANY has been incorporated by Harry C. Mitten, Harry E. Helm and Edward Correll. The company is capitalized at $15,000 and proposes to manufacture electric lighting fixtures.

THE MILLER ELECTRIC COMPANY of Terre Haute, Ind., has been chartered with a capital stock of $10,000 by Frank B. Miller, Frank E. Wissel, E. C. Kadel and Albert F. Fischer.

THE PORTLAND (IND.) ELECTRIC COMPANY has been incorporated with a capital stock of $35,000 by O. F. Bickel, A. E. Chew and J. A. Morrison to deal in electrical supplies.

THE KRUSE ELECTRIC COMPANY of Fort Wayne, Ind., has been incorporated with a capital stock of $75,000 by F. G. Kruse, C. W. Tracht and C. P. Squires. The company proposes to deal in electrical equipment and supplies.

THE LAFAYETTE (IND.) SERVICE COMPANY has been incorporated by F. H. Cutshall, J. M. Barrett, Jr., and Henry Williams, Jr. The company is capitalized at $10,000 and proposes to supply electricity for lamps and motors.

THE INDIANA POWER & LIGHT COMPANY of Butler, Ind., has been incorporated by L. Hooper, C. A. Olson, Don J. Blair, A. W. Wright and C. A. Engel. The company is capitalized at $100,000 and proposes to supply electricity for lamps, heaters and motors.

THE LEIGHTON (IOWA) ELECTRIC COMPANY has been incorporated with a capital stock of $10,000 to supply electricity for lamps and motors in Leighton. John R. Brower of Leighton is one of the incorporators.

THE ELECTRIC SPECIALTY COMPANY of Indianapolis, Ind., has been chartered with a capital stock of $30,000 by Isaac P. Geese, K. G. Whitney and F. M. Dickerman. The company proposes to deal in electrical devices and supplies.

New England States

AUGUSTA, ME.—The Central Maine Power Company has applied to the Public Utilities Commission for authority to purchase plants and system of the Knox County Electric Company, the Androscoggin Electric Company and the Oxford Electric Company. Harvey D. Eaton of Waterville is president.

WOODSTOCK, N. H.—The McNorton Falls water power, owned by the Publishers' Paper Company, it is reported, has been sold to parties who will soon develop it.

PITTSFIELD, MASS.—The Pittsfield Electric Company has applied to the Department of Public Utilities for permission to issue $125,000 in capital stock for extensions and improvements to its plant.

SOUTHWICK, MASS.—The question of issuing $10,000 in bonds to establish an electric light plant within the town limits is under consideration.

SPRINGFIELD, MASS.—The Wico Electric Company is contemplating the erection of a new plant in West Springfield. The first of the four units is to cost about $150,000.

WORCESTER, MASS.—The Worcester Electric Light Company has petitioned the City Council for permission to make additions to its street-lighting system.

NEW LONDON, CONN.—The United States Electric Company, 108 State Street, it is reported, is planning to erect a new power plant.

STAMFORD, CONN.—The South New England Telephone Company is planning to construct a telephone exchange on Main Street, to cost $100,000. L. W. Robinson, 42 Church Street, New Haven, is architect.

Middle Atlantic States

BATAVIA, N. Y.—The Genesee Light & Power Company has petitioned the Public Service Commission for permission to extend its transmission lines to Darien.

BUFFALO, N. Y.—The Olympia Amusement Company, 130 Broadway, is planning to construct a theater and office building, to cost $750,000.

DUNKIRK, N. Y.—Plans are being prepared by the Atlas Crucible Steel Company for extensions to its local plant, to cost about $1,800,000. Among the new buildings to be erected are an electric melting building, inspecting and annealing buildings, extensions to four mills, and a new transformer station, 40 ft. x 140 ft. The new equipment will include a 6-ton Heroult furnace, heating and annealing furnaces and other electrical equipment.

FILLMORE, N. Y.—The Fillmore Electric Company has taken over the plant of the Genesee Valley Power Company and will soon build a hydro-electric plant in Fillmore to develop 600 hp., and also extend its transmission line to Belmont, Belfast and other adjoining towns.

HAMILTON, N. Y.—The White Company, Norwich, N. Y., has purchased the municipal electric light plant for $70,000. Extensive improvements, including the installation of new generating equipment, is planned by the new owners.

MEDINA, N. Y.—The Western New York Utilities Company has applied to the Public Service Commission for permission to issue $208,000 in bonds and $94,300 in capital stock, for new construction work, the cost of which is estimated at $260,000. The company is developing a hydro-electric plant at Waterport.

NEW BERLIN, N. Y.—Application has been made to the Public Service Commission by the Berholme Power Company for permission to issue $25,000 in bonds. The company is planning a hydro-electric development, including power house and generating unit, to cost about $13,000, and the erection of transmission lines to cost $6,775.

NEW YORK, N. Y.—The New York Edison Company is planning to build a substation on Cedar Street, to cost about $75,000. William Whitehill, 12 Elm Street, is engineer.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

NEW YORK, N. Y.—Bids will be received by the superintendent of school buildings of the Board of Education, Room 2800, Municipal Building, New York, until April 27, for installing electric light equipment in Public Schools 9 and 121, borough of Manhattan, and in Public Schools 51, 57, 67 and 70, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at temporary estimating room, 6th floor, Brooklyn branch of the Board of Education, 131 Livingston Street, Brooklyn, N. Y. C. B. J. Snyder is superintendent of school buildings.

OLEAN, N. Y.—The Olean Electric Company is planning to extend its transmission lines to the towns of Bolivar, Wirt, Genesee and adoining villages to furnish electricity for lamps and motion.

ROCHESTER, N. Y.—Authority has been granted to the Rochester Gas & Electric Corporation by the Public Service Commission to issue bonds for $500,000 for contemplated additions.

ROME, N. Y.—Plans have been prepared by C. W. Knight, engineer, Rome, for the construction of a 350-hp. hydro-electric plant at Ridge Mills, on the Mohawk River, to cost about $65,000.

ROSSIE, N. Y.—Plans are under consideration by George N. Wilson for a 500-hp. hydro-electric development on the Indian River.

SONYEA, N. Y.—Bids will be received by Percy L. Lang, president of the board of managers, Craig Colony for Epileptics, Sonyea, N. Y., until May 11, for insulation of refrigerator rooms, dining room and kitchen buildings. Plans and specifications may be obtained at the Department of Architecture, Capitol, Albany, N. Y.

UTICA, N. Y.—Bids will be received by S. W. Haven, chairman of the Board of Supervisors of Oneida County, until May 12, for 1,000 and 2,000 25-watt and 40-watt lamps, respectively.

NEWARK, N. J.—Contract has been awarded to the Fleischman Construction Company, New York City, for the erection of a theater by Loew's Enterprises, to cost $400,000. T. W. Lamb, 644 Eighth Avenue, New York, N. Y., is architect.

ROCKAWAY, N. J.—The Borough Council is planning to have improvements made to the street-lighting system. The service is supplied by the New Jersey Power & Light Company of Dover.

TRENTON, N. J.—The Nearpara Rubber Company, 79 Prince Street, has awarded contract to the Bethlehem Construction Company, Bethlehem, Pa., for the construction of a new rubber plant and power house, to cost $150,000.

TRENTON, N. J.—The Pocono Rubber Company has had plans prepared for the construction of a power house in connection with the establishment of its proposed local plant. The company recently took over the property of the Howard Demountable Rim Company, 1851 East State Street.

TRENTON, N. J.—The Tri-County Electric Company has increased its capital stock from $25,000 to $125,000.

PHILADELPHIA, PA.—Contract has been awarded by H. C. Aberle, A and Clearfield Streets, for the construction of a five-story hosiery factory, 80 ft. x 200 ft., and a power house, 60 ft. x 60 ft., to William Steele & Sons, Sixteenth and Arch Streets.

PHILADELPHIA, PA.—The Standard Electric Welding Company, 1939 East Sergeant Street, is planning the installation of new electric welding apparatus.

CLAYMONT, DEL.—The Town Council is considering the installation of a new electric street-lighting system on the Philadelphia turnpike. The Claymont Community League is interested in the project.

BALTIMORE, MD.—Plans have been prepared by the Globe Shipbuilding & Dry Dock Company for the erection of a power plant, 35 ft. x 110 ft., on the south side of the Patapsco River, between Brooklyn and Fairfield Avenues.

CECILTON, MD.—Plans are under consideration by the Town Council for reconstruction of the municipal electric light plant, recently destroyed by fire.

CUMBERLAND, MD. — The Crystal Laundry Company is having plans prepared for the construction of a laundry, garage and power house, to cost about $200,000. T. W. Biddle, care of Springfield Tire Company, Cumberland, is architcet.

LAUREL, MD.—A bond issue has been approved by the State Legislature for construction of an addition to the municipal electric light plant.

KANAWHA, W. VA.—The Libby-Ownes Company is contemplating building an addition to the power plant at its glass works, to cost about $50,000.

MARTINSBURG, W. VA.—A new electric power plant, to cost about $100,000, will be erected at the local mills of the Interwoven Mills, Inc. The main offices of the company are at 390 George Street, New Brunswick, N. J.

SOUTH CHARLESTON, W. VA.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for electrical equipment for main substation, furnishing and installing switchboards, oil switches and barriers, buses and connections, storage battery motor generator set, transformers, disconnecting motor starters, and other electrical equipment furnished by the government; and making the necessary connections for a complete indoor substation ready for operation at the naval ordnance plant. Drawings and specifications may be obtained on application at the Bureau of Yards and Docks or inspector of ordnance in charge of plant named. Cost is estimated at $195,000.

FREDERICKSBURG, VA.—Contract has been awarded to the Fredericksburg Power Equipment Company by the Rappahannock Electric Light & Power Company for the construction of an addition to its plant, to cost about $35,000. E. C. L. Ficklen is secretary.

SCOTTSVILLE, VA. — The Scottsville Power Company, recently organized, is planning to build a hydro-electric plant on James River with transmission system connecting Richmond, Lynchburg, Roanoke, Charlottesville, Staunton and Orange. John L. Pitts of Scottsville is president.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 5, for furnishing and installing electric lighting fixtures in the United States post offices at Hone Grove, Texas; Mount Pleasant, Mich.; Rhinelander, Wis.; Sunbury, Pa., and the United States post office and courthouse at Woodward, Okla.

North Central States

BAY CITY, MICH.—The American Worsted Yarn Company is planning the construction of a four-story factory, to cost about $300,000.

KALAMAZOO, MICH.—Contract has been awarded by the Handley-Knight Company to Henry L. Van der Vorst of Kalamazoo for the construction of a three-story automobile factory, 80 ft. x 800 ft. The plant will be equipped for electrical operation.

MUIR, MICH.—The Council has voted to install an electric street-lighting system in the village.

RIVER ROUGE, MICH.—The Ford Motor Company is constructing a 25,000-kw. power plant at River Rouge, to be completed by next winter. The equipment will include two generators having a total capacity of 25,000 kw., four boilers with a total rating of 10,560 hp., and eleven motor-generators with a total rating of 8,050 kw. The company will continue to purchase energy of the Detroit Edison Company.

SAGINAW, MICH.—The Consumers' Power Company of Jackson proposes constructing a power plant at Zilwaukee, on the Saginaw River. The work includes a generating station of 30,000 kw. capacity. The cost is estimated at about $4,893,000.

CLEVELAND, OHIO.—The Cleveland Railway Company is having plans prepared for the construction of three substations, to be located at West Seventy-third Street and St. Clair Avenue, East Eightieth Street and St. Clair Avenue and at East 152d Street and St. Clair Avenue. The cost is estimated at $100,000 each. L. P. Crecelius is engineer.

INDIANAPOLIS, IND.—The Acme Aluminum & Brass Works, 420 South Harding Street, is contemplating extensions to its works, including a new power plant, to cost about $40,000.

MARION, ILL.—Improvements to the street-lighting system, to cost about $54,000, are under consideration.

MILWAUKEE, WIS.—Bids will be received by the Sewerage Commission, City Hall, until June 3 for construction of sewerage disposal plant. Proposals will be received on four different types of plant, one of which may be selected as follows: Proposal 1, plant R-R—For four 30,000-cu.ft. compressors of the reciprocating type, which may be operated by a reciprocating steam engine or by Diesel oil engines; one 10,000-cu.ft. compressor of the reciprocating type, which may be operated by a reciprocating steam engine or by a Diesel oil engine; five air washers and coolers; three 626-kw. generators, which may be operated by high-pressure steam turbines, Diesel oil engines or by reciprocating steam engines; one switchboard complete with instruments, switches and wiring; one oiling system. Proposal 2, plant H-T-R—Four 30,000-cu.ft. compressors of the horizontal hydro-turbine type, which shall be operated by a vertical reciprocating steam engine; one 10,000-cu.ft. compressor of the horizontal hydro-turbine type, which shall be operated by a vertical reciprocating steam engine; three 625-kw. generators, which may be operated by high-pressure steam turbines or by reciprocating steam engines; one switchboard complete with instruments, switches and wiring; one oiling system. Proposal 3, plant T—Four 30,000-cu.ft. blowers of the horizontal centrifugal type, which shall be operated by horizontal high-pressure steam multistage turbines; one 10,000-cu.ft. blower of the horizontal centrifugal type, which shall be operated by horizontal high-pressure steam multistage turbine; five air washers and coolers; three 625-kw. horizontal high-pressure steam turbines and generators; one switchboard complete with instruments, switches and wiring; one oiling system. Proposal 4, plant D-H-T—Four 30,000-cu.ft. compressors of the horizontal hydro-turbine type, which shall be operated by full Diesel oil engines; one 10,000-cu.ft. compressor of the horizontal hydro-turbine type, which shall be operated by a full Diesel oil engine; three 625-kw. horizontal engine-type generators, which shall be operated by full Diesel oil engines; one switchboard complete with instruments, switches and wiring; one oiling system. Specifications, etc., may be obtained at the office of the Sewerage Commission upon deposit of $5. John H. Fowles is secretary of the commission.

SHEBOYGAN, WIS.—Steps have been taken to organize a co-operative company for the purpose of furnishing electricity for lamps and motors to farmers between Sheboygan Falls, Five Corners, Waldo and Cascade and ultimately to provide for the districts surrounding Hingham, Adell and Random Lake. It is proposed to secure the electricity from the Eastern Wisconsin Electric company at Sheboygan. Henry Timmer of Waldo is interested in the project.

FRAZEE, MINN.—Bonds to the amount of $34,000 have been voted to erect a high-tension transmission line from Frazee to Perham, and also to build a distributing system and a white way in this city. Work will begin at once by the Otter Tail Power Company of Fergus Falls on the proposed line.

MINNEAPOLIS, MINN.—Bids will be received by the Board of Charities and Correction, Court House Building, Minneapolis, until April 28, for a complete refrigeration plant for Lymanhurst Hospital. Charles L. Pillsbury Company are engineers.

NEW ULM, MINN.—Bids will be received by the Mayor and City Council, addressed to William P. Backer, city clerk, until May 13, for the construction of a new municipal light, water, power and heating plant as follows: (1) General contract; (2) reciprocating steam engine, alternating-current generator, exciter, switchboard, moving and resetting present McIntosh-Seymour unit, foundations, wiring between generator, exciter and switchboard; (3) water tube boilers, breeching boiler foundations, and brick settings; (4) stokers, air ducts, fans, regulators, and all necessary auxiliary equipment; (5) repairing present reinforced concrete chimney; (6) pipe, fittings and valves for steam plant and connections to heating mains, feed water heater, feed water meter, boiler-feed pumps and all necessary auxiliary equipment. A. J. Mueller is superintendent of electric light and water departments.

ST. PAUL, MINN.—The City Council has awarded contract to the Electric Construction Company for the installation of an ornamental street-lighting system on University Avenue, to cost about $109,000.

ST. PAUL, MINN.—The City Council is considering replacing the gas street lamps now in use in the district bounded on the north by Summit Avenue, south by St. Clair Street, west by Short Line tracks, and east by Pleasant Avenue, with electric lamps. There are in this district between 500 and 600 lamps.

MOUNT AYR, IOWA.—The municipal electric light plant was recently destroyed by fire, it is reported, causing a loss of $35,000.

ST. LOUIS, MO.—Arrangements have been made by the Union Electric Light & Power Company for an issue of $2,500,000 in bonds, part of the proceeds to be used for extension to its system.

WORTHINGTON, S. D.—Improvements are contemplated to the municipal electric light plant, including the installation of a 20-hp. engine and a 12-kw. generator. W. F. Berens is manager.

MILFORD, KAN.—The construction of an electric light and power plant, waterworks system and ice factory in Milford is under consideration. A good water power is available.

OTTAWA, KAN.—Bonds to the amount of $20,000 have been voted for improvements to the municipal electric light and water plants.

Southern States

ASHEVILLE, N. C.—Work will soon be started by the Carolina-Tennessee Power Company on its proposed hydro-electric plant on the Hiawassee River, to develop 60,000 hp.

KINGSTON, N. C.—Bids will be received by the Mayor and City Council, City Hall, until May 11, for power plant equipment as follows: One 1,500-kw., 1,875 kva. at 80 per cent power factor turbo-generator unit; one surface condenser complete with dry vacuum and hot-well pumps, expansion joint, exhaust valve and atmospheric valve; one 25-kw. turbine-driven exciter unit, one seven-panel switchboard, two 25-kw., 6.6.-amp. series street-lighting transformers, two horizontal motor-driven centrifugal circulating pumps, two 500-hp., 225 lb. horizontal water-tube boilers, one steel breeching, one 1,500-hp. open feed-water heater, two superheaters, two underfeed mechanical stoker units complete, two outside-end-packed, pet-valve-type boiler-feed pumps, two brick settings for boilers, two sets soot cleaners, two sets automatic feed-water regulators, one radial brick chimney. Specifications, etc., may be obtained on application to W. C. Olsen, consulting engineer, Sumter, S. C. John E. Weyher is superintendent of the municipal electric plant.

TAHOKA, TEX.—The City Council has authorized an issue of $15,000 in bonds for the installation of equipment in the municipal electric light plant.

WACO, TEX.—The Central Texas Electric Railway Company has rejected all bids submitted for the construction and equipping of the first section (6½ miles), of its proposed railway from Waco to Temple. New bids, it is understood, will be asked for.

ST. JOSEPH, LA.—City officials are considering a bond issue for financing construction of a municipal electric light plant.

MIAMI, OKLA.—Bonds to the amount of $420,000 have been voted for water and light plant, and also for sewers and sewage disposal plant at Miami.

TONKAWA, OKLA.—Preparations are being made for extensions to the electric light plant and waterworks for which bids have been received. Johnson & Benham, Firestone Building, Kansas City, Mo., are engineers.

COLUMBIA, S. C.—A new heating and electric plant, to cost about $50,000, will be installed in the State Capitol. S. W. Cannon is state electrician.

SAVANNAH, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 10, for construction of medical officers' quarters for the United States marine hospital at Savannah, including heating, electric conduits and wiring.

JACKSONVILLE, FLA.—The City Commission has authorized the expenditure of $6,000 for the reconstruction of certain foundations at Talleyrand power plant upon which to install a new 10,000-kw. turbine generator.

CLEVELAND, TENN.—The Council is considering the purchase of an electrically-driven pumping unit having a capacity of 500 gal. per minute under a 200-ft. head.

LEXINGTON, MISS.—Preparations are being made for the construction of a new municipal electric light plant to cost about $60,000. Williams & Lebby of Yazoo City, are constructing engineers.

BRINKLEY, ARK.—The Brinkley Water & Light Company, it is reported, contemplates the erection of a transmission line to Cotton Plant and Claredon to cost about $260,000.

WALTERS, OKLA.—A bond issue of $125,000 has been voted for the construction of an electric light plant and a waterworks system and sewers.

DENISON, TEX.—Bonds amounting to $244,000 have been voted for the installation of electrical equipment in two local pumping stations and to install an ornamental electric street-lighting system.

LIBERTY, TEX.—The Liberty Light & Power Company, recently incorporated, plans to construct an electric light and power plant. A. J. Riviere is interested.

NEWCASTLE, TEX.—The Newcastle Light, Power & Ice Company, recently organized with a capital stock of $50,000, contemplates the installation of an electric light and power plant. Incorporators are W. F. Nance, W. H. Husted and J. H. Arnold.

Pacific and Mountain States

SALEM, ORE.—Negotiations are under way by the Oregon Pulp & Paper Company for the purchase of all "north power" on Mill Creek from the Salem Flouring Mills Company. The paper company is seeking additional facilities for power development which will be needed for its new mill. It proposes to erect a power plant, to cost about $50,000, on the site known as the Scotch mill, at the foot of North Mill Creek. The plans provide for a development of 1,000 hp.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the Pacific Gas & Electric Company permission to issue $10,000,000 in bonds, the proceeds to be used to finance the Pitt River project.

SAN FRANCISCO, CAL.—Plans are under consideration by the Pacific Fruit Express Company, 65 Market Street, for extensions and improvements to its icing and pre-cooling plants at different locations, to cost, including equipment, about $1,500,000. The conversion of several plants from steam to electric operation and the erection of new cold storage plants are included in the proposed work. C. M. Secrist is vice-president and general manager.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to Public Utilities Commission for permission to extend its lines in Juab County.

PUEBLO, COL.—Work will begin at once on the construction of a new 10,000-hp. electric generating station, for the Arkansas Valley Railway, Light & Power Company. George F. Pythian, constructing engineer for the H. M. Byllesby Company of Chicago, Ill., is in charge.

Canada

LONDON, ONT.—The construction of a dam at Springbank, on the Thames River, to develop 1,000 hp., is under consideration by the Public Utilities Commission. The cost, including equipment, is estimated at $300,000. E. V. Buchanan is engineer.

MONTREAL WEST, QUE.—Plans are being prepared for the installation of a new street-lighting system in Montreal West, to cost about $100,000.

(Issued April 6, 1920)

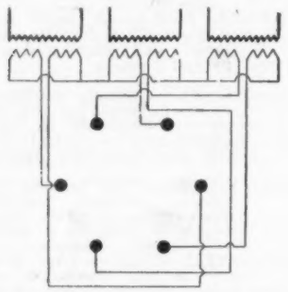
1,335,338. ELECTROLYTIC CELL; Henry C. Jenkins, London, Eng. App. filed Sept. 3, 1919. Promotes uniform circulation of electrolyte in region of exposed electrode but hinders circulation in region of protected electrode.

1,335,357. CONTROLLING MEANS FOR ELECTRIC MOTORS; Frank G. Warburton, Montreal, Quebec, Can. App. filed Feb. 11, 1915. For motor-driven paper-making machines, paper and cloth printing and coating machines operating in any desired speed relation.

1,335,392. HEATER FOR CARBURETORS; Charles L. Rayfield, Chicago, Ill. App. filed Dec. 26, 1917. Hydrocarbon liquid circulates through device or is heated by convection.

1,335,417. ELECTROPNEUMATIC ORGAN ACTION; Basil G. Austin, Hartford, Conn. App. filed May 29, 1916. Magnetically operated valve structure.

1,335,418. MOTOR CONTROLLER; Thomas E. Barnum, Milwaukee, Wis. App. filed June 21, 1917. Obviates noise of operation and subsequent hum resulting from use of alternating-current electromagnets and solenoids as in hospitals.



No. 1,336,017. Electric Blast Furnace

1,335,423. ELECTRICAL RADIATOR; Robert Bonnaval, Pittsburgh, Pa. App. filed Aug. 30, 1919. Fan wheel diffuses heat from transformer secondary.

1,335,428. RAIL BOND; Lawrence P. Crecelius, Cleveland, Ohio. App. filed May 3, 1916. Both conductor and terminal sleeve conductor brazed to rail.

1,335,483. ELECTRIC HEATING APPARATUS; Ora A. Colby, Larimer, Pa. App. filed Sept. 9, 1916. Resistance element strip of conducting material wound upon insulated supports serves as terminal conductor.

1,335,507. ELECTRIC STARTING SYSTEM FOR INTERNAL-COMBUSTION ENGINES; August Kazenmaier, Stuttgart, Germany. App. filed Dec. 2, 1915. Initial operation for meshing normally disengaged motor and engine gears and for driving engine up to critical speed at which it starts under its own power.

1,335,536. SHAFT CONSTRUCTION FOR GENERATORS; Ira T. Swartz and Alvine T. Wallace, Indianapolis, Ind. App. filed Oct. 22, 1917. Avoids use of stepped sections or threaded parts.

1,335,541. BOOSTER SYSTEM; Frederick W. Walker, Port Washington, Wis. App. filed Aug. 5, 1914. Electrolytic rectifier or converter prevents excessive drop in voltage.

1,335,542. POT-HEAD CONNECTOR; Paul F. Williams, Chicago, Ill. App. filed March 15, 1910. Bowl for three cables with removable cover.

1,335,550. SEPARABLE CONTACT DEVICE; Reuben B. Benjamin, Chicago, Ill. App. filed June 24, 1915. Binding terminal carrying member is provided with contacts for detachable engagement with contacts of device electrically connected with supply circuit.

1,335,578. ELECTRICAL TRANSMITTING APPARATUS; Henry K. Harris, Westminster, London, Eng. App. filed July 1, 1916. Resembles typewriter and causes electrical impulses produced and transmitted for operating advertising mechanisms.

1,335,584. METHOD OF AND APPARATUS FOR WELDING; Simon Lake, Milford, Conn. App. filed Dec. 3, 1919. Combines steps of heating and hammering in welding operation.

1,335,592. TRANSMITTING DEVICE FOR MICRO OSCILLATIONS; Birger Meidell, Christiania, Norway. App. filed March 8, 1918. Weakest oscillations reach working part of mechanism without loss of energy.

Record of Electrical Patents

Notes on United States Patents

1,335,595. SOUND-RECORDING MEANS; Christian Moore, Akron, Ohio. App. filed Feb. 7, 1919. Recording vibrations on a strip of celluloid.

1,335,596. INDICATING AND RECORDING APPARATUS; Donald B. Morison, Hartlepool, Eng. App. filed April 9, 1918. Impulses act cumulatively to impart movement to an indicator.

1,335,634. INSULATOR; Frank M. Amos, Wheeling, W. Va. App. filed May 7, 1919. Wire automatically forced into groove in base.

1,335,644. PORTABLE ELECTRIC LIGHT; Bernard Benedict, New York, N. Y. App. filed June 17, 1919. Flashlight placed on table and used as a lamp.

1,335,646. ELECTRICAL TESTING DEVICE; Richard C. Bierbower, San Antonio, Tex. App. filed Aug. 20, 1917. Compact board for testing armatures, condensers, magnetos, lamps, insulation, spark plugs, etc.

1,335,647. ELECTRICAL TESTING DEVICE; Richard C. Bierbower, San Antonio, Tex. App. filed June 11, 1918. Fluxmeter for testing strength of magnets.

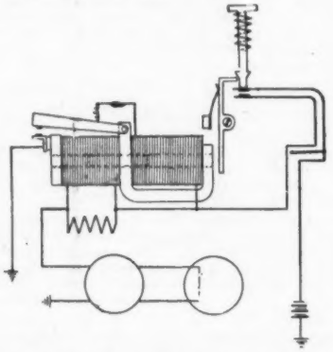
1,335,650. COMBINED LAMP AND HEATER; Philip C. Browne, Portland, Ore. App. filed Feb. 11, 1919. Lamp stand contains resistance elements.

1,335,707. ELECTRIC ALARM SYSTEM; Max Yarow, Philadelphia, Pa. App. filed Oct. 10, 1918. Alarm sounded to telephone central office when wires are cut.

1,335,709. ELECTRICAL TIME SWITCH; Lauritz H. J. T. Bjornsen, Copenhagen, Denmark. App. filed Aug. 29, 1917. Expansion and subsequent contraction utilized to close or interrupt an electrical circuit.

1,335,738. SYSTEM OF ELECTRICALLY INDICATING ON BOARD SHIP THE DEPTH OF SEA WATER; Yoshinao Kawakita, Hongo-Ku, Tokyo, Japan. App. filed July 5, 1918. Two balanced alternating-current circuits, including sea water, become unbalanced owing to influence of ground, and unbalanced current is measured by means of a sensitive dead-beat galvanometer.

1,335,739. TELEPHONE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed Oct. 2, 1917. Intercommunicating systems provided with a trunk circuit extending to a central office and multiplied to each of stations included.



No. 1,336,158. Automatic Circuit-Opening Switch for Ignition Systems

1,335,801. INSULATOR; Louis Steinberger, Brooklyn, N. Y. App. filed Nov. 14, 1916. For high voltages and high frequencies in wireless work.

1,335,803. TRANSFORMER MOUNTING; Chester H. Thordarson, Chicago, Ill. App. filed Jan. 6, 1919. For cylindrical oil-cooled transformer.

1,335,828. LAMP-SOCKET STRUCTURE; Henry A. Framburg, Berwyn, Ill. App. filed May 7, 1919. Container for lamp-supporting socket.

1,335,837. INDUCTION COIL; Edward B. Jacobson, Pittsfield, Mass. App. filed Dec. 17, 1918. Spark coils for ozonating and ignition.

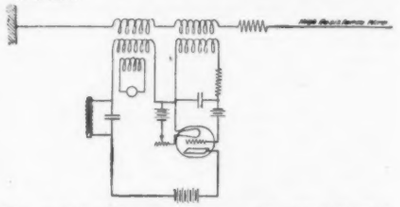
1,335,846. ELECTROLYTIC PROCESS AND PRODUCT; Matthew M. Merritt, South Middleton, Mass. App. filed Nov. 2, 1917. Deposits copper or other metal on non-conductive bodies such as surface of aeroplane propellers.

1,335,875. ELECTRICAL ARC WELDING; Jack Churchward, New York, N. Y. App. filed Jan. 14, 1920. Monel metal conducts current and also supplies the non-corrosive metal to be deposited by welding process.

1,335,895. ELECTRODE HOLDER; Johnson Hughes, Philadelphia, Pa. App. filed March 24, 1919. Light-weight water-cooled holder.

1,336,017. ELECTRIC BLAST FURNACE; James Bibby and Jens O. Boving, London, Eng. App. filed Jan. 16, 1919. Current from transformers produces heat by ohmic resistance between electrode entering charge as distinguished from arc heat between electrode above charge.

1,336,127. TERMINAL MEANS FOR BATTERY PLATES; Campbell C. Carpenter, Niagara Falls, N. Y. App. filed Aug. 13, 1917. Connects straps and plates to withstand shocks.



No. 1,336,378. Antenna with Distributed Positive Resistance

1,336,158. AUTOMATIC CIRCUIT-OPENING SWITCH FOR IGNITION SYSTEMS; Gordon A. Ream, Detroit, Mich. App. filed April 18, 1917. Solenoid operated switch for internal-combustion engines.

1,336,196. MAGNETO WITH WATER-TIGHT CASING; George A. Chailliley, Lyon St., Clair Caluire, France. App. filed March 6, 1918. Field frame carries pole pieces cast together; water-tight casing has oil holes covered by rings.

1,336,199. TROLLEY; Edgar S. Combs, Rochester, N. Y. App. filed April 8, 1918. Wheel keeps in proper alignment with trolley wire.

1,336,253. TELEPHONE SUPPORT; Willis I. Miller, Cleveland, Ohio. App. filed March 31, 1919. Means for elevating or lowering mouthpiece.

1,336,281. PROCESS AND APPARATUS FOR THE ELECTROLYTIC DECOMPOSITION OF CHLORIDES; Beniamino Cataldi, Turin, Italy. App. filed May 12, 1919. Forms hydrated oxide, also chlorine and hydrogen in free state.

1,336,290. ELECTRICAL FITTING; Morris F. Finkelstein, New York, N. Y. App. filed Feb. 8, 1919. Connecting ends of wire in an insulated casing.

1,336,306. AUTOMOBILE PROTECTIVE DEVICE; Otto C. Lohse, Bloomington, Ill. App. filed July 9, 1917. Unauthorized persons in starting car cause horn to sound.

1,336,318. ELECTRIC CLOCK AND SIGNAL SYSTEM; Herman C. Prey, Watertown, S. D. App. filed Dec. 19, 1917. Signal operated from a master clock at a remote point and at any predetermined time.

1,336,378. ANTENNA WITH DISTRIBUTED POSITIVE RESISTANCE; Michael I. Pupin, Norfolk, Conn. App. filed Oct. 1, 1915. Receiving wave conductors loaded with resistance to screen them against waves which have the character of electrical pulses of short duration known as atmospherics or strays.

1,336,395. LAMP-SOCKET CONSTRUCTION; Oscar S. Swanson, Jamestown, N. Y. App. filed Dec. 10, 1918. Cap with insulation molded into it.

1,336,398. RADIO-SIGNALING APPARATUS; Roy A. Weagant, New York, N. Y. App. filed Feb. 1, 1918. Conductors for radio-frequency currents.

1,335,933. HIGH-VOLTAGE-CURRENT-DISTRIBUTING APPARATUS FOR THE ELECTRIC IGNITION APPARATUS OF INTERNAL-COMBUSTION ENGINES; Jacques Bohli, Obach, Solothurn, Switzerland. App. filed May 13, 1919. Arranges points of ignition for several engine cylinders in two ignition circuits connected in parallel.